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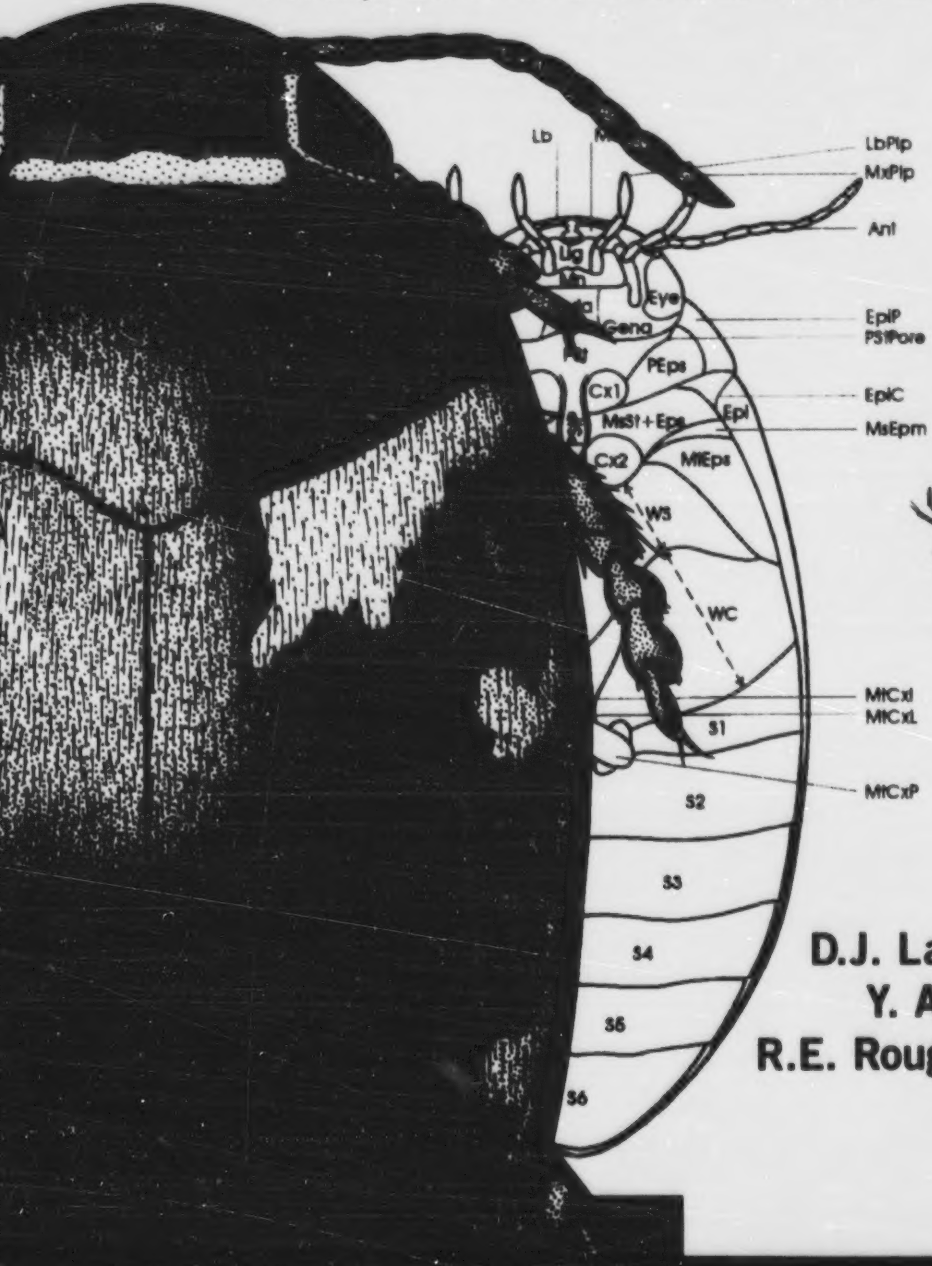
with emphasis on the fauna of Canada and Alaska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D.J. Larson
Y. Alarie
R.E. Roughley

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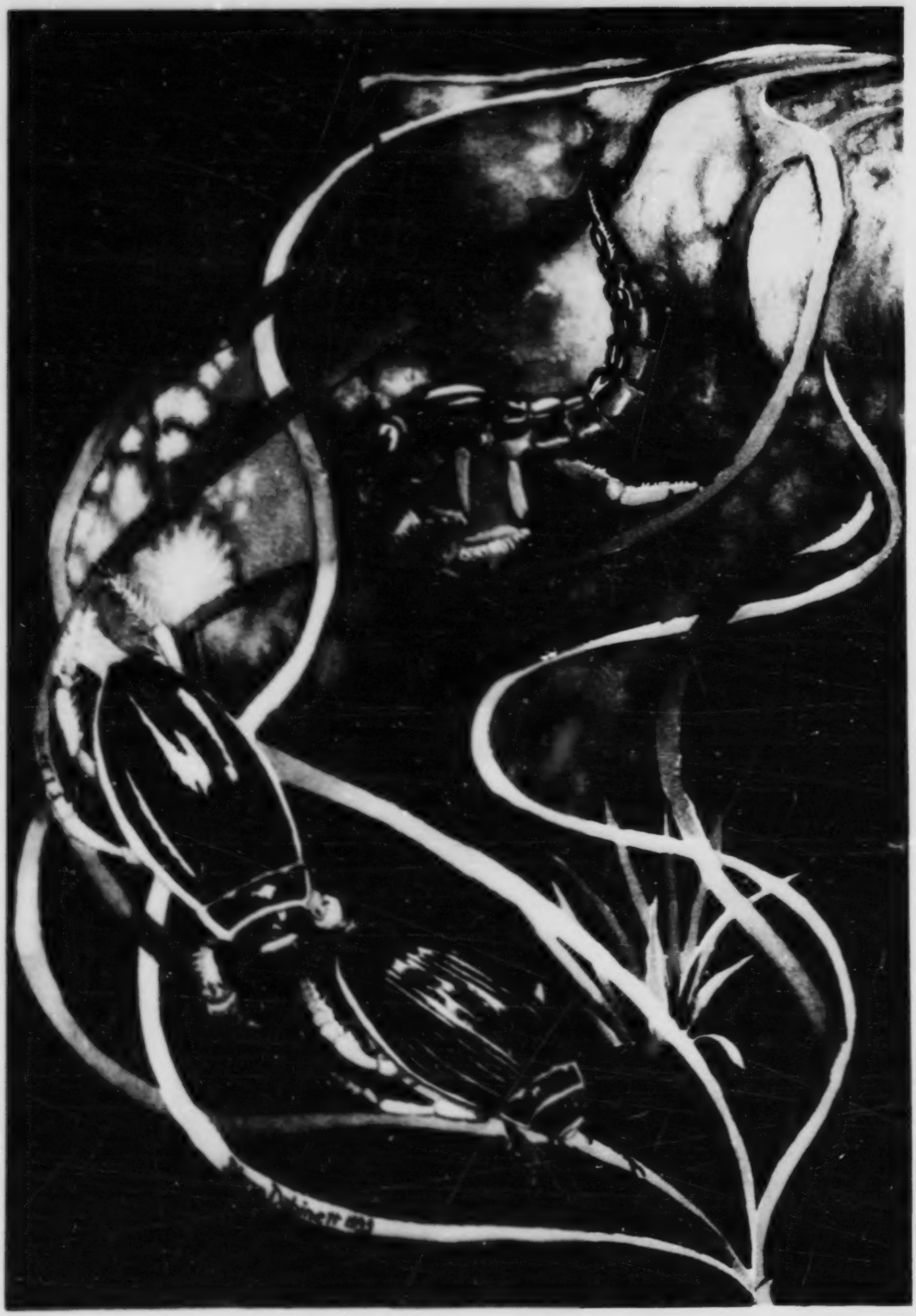

Dystiscus alaskanus Balfour-Browne. Clockwise from upper right: mature larva, adult female, adult male.

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with emphasis on the fauna of Canada and Alaska

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Abstract

The predaceous diving beetle (Coleoptera: Dytiscidae) fauna of Canada, United States, and for some taxa also northern Mexico, is reviewed. The seven subfamilies represented in the region are defined and keyed. Adults and larvae (when known) of the 51 genera occurring in the area are keyed and for most a diagnostic description is provided. The focus of the work is on the fauna of Canada and Alaska and adults of the 276 species known from this region are treated in detail. These species are keyed and for most genera the keys also include species known only from south of Canada. For each Canadian - Alaskan species, the following information is presented: nomenclature and synonymy; selected references, description including illustrations of taxonomically important characters, comments on classification or variation, notes on ecology and a description of the range accompanied by a map of Canadian - Alaskan collection records and United States state records. Checklists of the dytiscid fauna of Canada - Alaska are presented with the distribution of the species recorded by province / territory and by Canadian ecozone. The biology of dytiscids is reviewed and the nature of the Canadian fauna discussed.

New taxa described are: The subfamily Hydrotrupinae Roughley is proposed for the monotypic genus *Hydrotrupes* Sharp. The genus *Hydrocolus* Roughley and Larson, type species *Hydroporus paugus* Fall, is described to include the members of the *Hydroporus oblitus* group (sensu Fall). New species are: *Agabus aztec* Larson (Puebla, Mexico), *A. gringo* Larson (Durango, Mexico), *A. maya* Larson (Chiapas, Mexico), *A. mexicanus* Larson (Michoacan, Mexico), *A. oaxacaensis* Larson (Oaxaca, Mexico), *A. xyztrus* Larson (New Jersey), *Hydrocolus oblitoides* Roughley and Larson (Arkansas), *H. rupinus* Roughley and Larson (Georgia), *Hydroporus aurora* Larson and Roughley (Northwest Territories), *H. boraeorum* Larson and Roughley (Northwest Territories), *H. gossei* Larson and Roughley (Newfoundland), *H. klamathensis* Larson and Roughley (Oregon), *H. zackii* Larson and Roughley (Nevada), *Sanfilippodytes bertae* Roughley and Larson (Alberta), and *S. setifer* Roughley and Larson (California). Members of the *Hydroporus vilis* group (sensu Fall) and *Hydroporus corvallis* Fall are transferred to the genus *Sanfilippodytes* Franciscolo.

The following new synonymy is proposed: *Bidessus subplicatus* Hatch junior synonym of *Uvarus subtilis* (LeConte); *Hydroporus acadianus* Balfour-Browne junior synonym of *Hydrocolus persimilis* (Crotch); *Hydroporus browni* Wallis junior synonym of *Sanfilippodytes terminalis* (Sharp); *Hydroporus californicus* Gordon and *Hydroporus fatigus* Gordon junior synonyms of *Hydroporus longiusculus* Gemminger and Harold; *Hydroporus elusivus* Gordon junior synonym of *Hydroporus tartaricus* LeConte; *Hydroporus falsificus* Brown junior synonym of *Sanfilippodytes compertus* (Brown); *Hydroporus funestus* Fall junior synonym of *Hydroporus transpunctatus* Chandler; *Hydroporus labradorensis* Fall junior synonym of *Hydroporus lapponum* (Gyllenhal); *Hydroporus solitarius* Sharp junior synonym of *Neoporus dimidiatus* (Gemminger and Harold); *Hydroporus somnus* Fall junior synonym of *Hydroporus rufilabris* Sharp; and *Hydroporus subvirescens* Fall junior synonym of *Hydroporus polaris* Fall.

Lectotypes are designated for: *Agabus clavatus* LeConte, *A. punctatus* Melsheimer, *Colymbetes taeniolatus* Harris, *Gaurodytes aeneolus* Crotch, *G. disintegratus* Crotch, *Hydroporus labradorensis* Fall, *Hydroporus sibiricus* J. Sahlberg, *H. subtonsus* LeConte, and *H. varians* LeConte. Neotypes are designated for *Hydroporus larsoni* Nilsson and *Hydroporus niger* Say.

Résumé

On examine la faune de dytiques prédateurs (Coléoptères : Dytiscidae) du Canada et des États-Unis ainsi que quelques taxons du Mexique septentrional. Les sept sous-familles représentées dans la zone donnée font l'objet d'une définition et d'une clef. Le signalement des insectes adultes et larvaires (s'ils sont connus) des 51 genres connus dans la zone est accompagné d'une clef et, pour la plupart, d'une description diagnostique. Étant donné que l'ouvrage porte en particulier sur la faune du Canada et de l'Alaska, on y traite en détail des adultes de 276 espèces que l'on retrouve dans cette zone. Les espèces sont recensées sous forme de clef et, pour la plupart des genres, les clefs comprennent également les espèces qui n'ont été signalées que dans le sud du Canada. Pour chaque espèce du Canada ou de l'Alaska, l'information suivante est présentée : nomenclature et synonymie, références choisies, description y compris illustrations de caractéristiques d'importance du point de vue taxonomique, commentaires sur la classification ou sur la variation, notes sur l'écologie et description de la répartition accompagnées d'une carte de signalement du Canada et de l'Alaska ainsi que d'une carte de signalement des États-Unis. On y présente aussi des listes de la faune de Dytiscidae du Canada et de l'Alaska, qui comprennent des données sur la répartition des espèces par province et territoire ainsi que par écozone canadienne. On examine la biologie des Dytiscidae et on discute de la nature de la faune canadienne.

Les nouveaux taxons présentés comprennent les suivants : On propose la sous-famille Hydrotrupinae Roughley pour englober le genre monotypique Hydrotrupes Sharp. On estime que le genre Hydrocolus Roughley and Larson, d'espèce type Hydroporus paugus Fall, comprend les membres du groupe Hydroporus oblitus (sensu Fall). Les nouvelles espèces sont : Agabus aztec Larson (Puebla, Mexique), A. gringo Larson (Durango, Mexique), A. maya Larson (Chiapas, Mexique), A. mexicanus Larson (Michoacan, Mexique), A. oaxacaensis Larson (Oaxaca, Mexique), A. xyztrus Larson (New Jersey), Hydrocolus oblitoides Roughley and Larson (Arkansas), H. rupinus Roughley and Larson (Géorgie), Hydroporus aurora Larson and Roughley (Territoires du Nord-Ouest), H. boraeorum Larson and Roughley (Territoires du Nord-Ouest), H. boraeorum Larson and Roughley (Territoires du Nord-Ouest), H. gossei Larson and Roughley (Terre-Neuve), H. klamathensis Larson and Roughley (Oregon), H. zackii Larson and Roughley (Nevada), Sanfilippodytes bertae Roughley and Larson (Alberta) et S. setifer Roughley and Larson (Californie). Les membres du groupe Hydroporus vilis (sensu Fall) et Hydroporus corvallis Fall sont transférés au genre Sanfilippodytes Franciscolo.

Les synonymes suivants sont proposés : Bidessus subplicatus Hatch synonyme subjectif de Uvarus subtilis (LeConte), Hydroporus acadianus Balfour-Browne synonyme subjectif de Hydrocolus persimilis (Crotch), Hydroporus browni Wallis synonyme subjectif de Sanfilippodytes terminalis (Sharp), Hydroporus californicus Gordon et Hydroporus fatigus Gordon synonymes subjectifs de Hydroporus longiusculus Gemminger and Harold, Hydroporus elusivus Gordon synonyme subjectif de Hydroporus tartaricus LeConte, Hydroporus falsificus Brown synonyme subjectif de Sanfilippodytes compertus (Brown), Hydroporus funestus Fall synonyme subjectif de Hydroporus transpunctatus Chandler, Hydroporus labradorensis Fall synonyme subjectif de Hydroporus lapponum (Gyllenhal), Hydroporus solitarius Sharp synonyme subjectif de Neoporus dimidiatus (Gemminger et Harold), Hydroporus somnus Fall synonyme subjectif de Hydroporus rufilabris Sharp et Hydroporus subvirescens Fall synonyme subjectif de Hydroporus polaris Fall.

On designe des lectotypes pour Agabus clavatus LeConte, A. punctatus Melsheimer, Colymbetes taeniolatus Harris, Gaurodytes aeneolus Crotch, G. disintegratus Crotch, Hydroporus labradorensis Fall, Hydroporus sibiricus J. Sahlberg, H. subtonsus LeConte et H. varians LeConte. Des néotypes sont désignés pour Hydroporus larsoni Nilsson et Hydroporus niger Say.

Preface

This project was conceived about 25 years ago following the publication of the senior author's "Predaceous water beetles of Alberta" (Larson 1975). The Alberta study pointed out that dytiscid beetles comprise a large element within the Canadian fauna yet their identification was difficult for the nonspecialist and the distribution and habitats of the species were only sketchily known. The initial and continued aims were to make the predaceous water beetle fauna of Canada accessible to as wide an audience as possible by summarizing available knowledge of the fauna, documenting the species present and their distribution and habitats, providing means for the identification of the taxa, and indicating where knowledge is especially lacking and where interesting and possibly productive research avenues lie. In order to achieve these aims it has been necessary to revise several genera, review the systematic position of many taxa and to seek out immature stages of various taxa. Some of the results of these studies have been published elsewhere as a base for this work but much new information, including descriptions of new taxa, is included here.

The initial geographical scope of the study was Canada and Alaska following the model of the now discontinued Agriculture Canada's "Insects and Arachnids of Canada" series. However, the Canadian fauna cannot be understood without reference to the overall Nearctic fauna and therefore the scope enlarged over time to include most of the North American fauna. This work treats all Nearctic genera and most species. Detailed treatment is provided for all species known from Canada. Non-Canadian species are treated as fully in some genera, in others these species are included only in keys. Only within genera where some species are too poorly known to allow their definition, are all Nearctic species not treated. The areas with the most incomplete coverage are the Gulf States and southwestern United States, namely western Texas to southern California and northern Mexico. For the rest of the continent, it is hoped that this work will provide a useful identification guide.

Our interests in beetles have been greatly encouraged by such monumental works as Arnett's (1963) review of the families and genera of North American beetles and Lindroth's (1963–1975) classical treatment of Canadian ground beetles. We hope that in a similar vein this work will aid and encourage others to look at water beetles with increased interest and appreciation and will stimulate research on these as yet poorly understood insects.

Acknowledgements

Knowledge of a continental fauna can only be achieved through the cumulative effort of many people. We thank all who have collected water beetles and deposited them in collections to which we have had access for without these contributions, our knowledge of the fauna would be very much poorer. We especially thank Mr. and Mrs. J. L. Carr, Calgary, who have been an ongoing source of specimens, information and general inspiration. Much of our knowledge of the water beetles of western Canada is due to their efforts, and they have freely shared their data and specimens with us.

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The distribution data upon which the maps are based was taken from specimens deposited in the following collections and museums.

ANSP- Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pennsylvania 19103, USA (D. Azuma).

AMNH - American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, USA (L. H. Herman).

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PART 1. INTRODUCTION AND BIOLOGY

INTRODUCTION

Coleoptera or beetles are divided into four main groups or suborders: Archostemata, Myxophaga, Adephaga and Polyphaga. Excellent overviews of the classification of Coleoptera are given in Lawrence and Newton (1982), Kukalová-Peck and Lawrence (1993), and Lawrence and Britton (1994). The suborder Adephaga is composed of nine or 10 families, depending upon which author is consulted. Historically they were divided into two main groups - terrestrial or Geadephaga and aquatic or Hydradephaga. The terrestrial members of Adephaga are the largely predatory ground and tiger beetles (Carabidae) and the mycophagous Rhysodidae. The remaining families of Adephaga are arranged into three superfamilies: Gyrinoidea (Gyrinidae), Haliploidea (Haliplidae) and Dytiscoidea (Trachypachidae, Amphizoidae, Hygrobiidae, Dytiscidae, Noteridae) which all show various degrees of aquatic adaptations. Interestingly this is also true for trachypachids of which the extant members are exclusively terrestrial. A summary of the classification of Adephaga is given by Beutel (1995). For many years the aquatic families were thought to represent a single monophyletic group. However, recently a series of different hypothesis about the evolution of aquatic Adephaga have been developed, depending on the character systems and life history stages studied. The most recent view (Beutel and Roughley 1988; Beutel 1995) has an aquatic life style being derived at least three times, once in each of the three aquatic superfamilies.

The Dytiscidae (predacious diving beetles) is a fairly large family of beetles distributed over most of the world. About 4,000 species are known and these are distributed among approximately 160 genera (Pederzani 1995; Nilsson and Roughley 1997); many of these genera are distributed globally. Dytiscid beetles can be very abundant in many local habitats, and together with the Hydrophilidae, they constitute the vast majority of beetles encountered in aquatic habitats. Adults and larvae are often very abundant in some habitats and are undoubtedly an important component of aquatic food webs, not only for fish but also for aquatic and shore birds, whereas they in turn prey on a wide range of smaller invertebrates. They are often collected in numbers during ecological studies of various aquatic habitats but as their identification has been difficult there are relatively few studies with species level identifications.

The North America fauna of dytiscids, which numbers about 500 species, has been studied rather extensively. Most of recent research has consisted of faunal studies of geographic regions or of revisions of selected taxa at the generic level. Many species are now fairly well known, however much more research is required at the supraspecific level before a stable and reliable classification can be achieved.

The history of classification of Dytiscidae is relatively long and complex. The genus name, *Dytiscus* L., which is supposedly derived incorrectly from the Greek word for "diver", was one of the original genera of Coleoptera or beetles recognized by Linnaeus (1758). The family name, Dytiscidae, is derived from *Dytiscus*. Originally, any beetle which was found in the water was considered to be a member of *Dytiscus*. Subsequently, most species that were described within *Dytiscus* have been removed to other genera; as well, several taxa which were originally included within Dytiscidae have been given family status. The most recent to be removed from dytiscids is probably the

Noteridae which until fairly recently was considered to be a subfamily of Dytiscidae and some recent European authors (Franciscolo 1979*a*; Pederzani 1995) retain the subfamily Noterinae. As here defined, the family is fairly uniform in structure. However, there is controversy over the number and organization of subfamilies. Most authors have recognized four subfamilies (excluding noterids): Laccophilinae, Hydroporinae, Colymbetinae, and Dytiscinae. However there has been a recent trend to recognize more subfamilies in that Copelatinae, Agabetinae, and Hydrotrupinae have been removed from Colymbetinae, Methlinae from Hydroporinae, and the Neotropical genus, *Notaticus* Zimmermann, is considered the sole representative of the subfamily Aubehydrinae. However, the status of all subfamilies is not unequivocally founded. We continue to treat Methlini as a tribe of Hydroporinae but otherwise recognize the recently proposed subfamilies.

METHODS

Scope

The primary focus of this work is the dytiscid fauna of Canada and all species within the country are treated in detail. Because a large proportion of the North American fauna is found in Canada, it has been possible to include almost all species that occur in North America north of Mexico in at least the keys. Some North American genera have been revised recently and the keys and species definitions based on these revisions are quite reliable. In other cases, the treatment of non-Canadian species is preliminary and represents more a cataloguing of what has been named rather than a sound characterization of the species present. Where taxonomic problems have been encountered, they have been identified.

Nomenclatural Information

For each North American taxon recognized, author, date and literature citation of the valid name are given. The nomenclatural information of higher taxa was drawn largely from Nilsson *et al.* (1989). Specific names used have been applied through examination of type specimens, comparison with reliably identified specimens or through reference to recent revisions. If a type specimen has been examined, information on type repository, sex and type number are given if this information has not been published in the cited references. Homonymy is indicated but if the senior homonym is not a dytiscid, neither a complete citation nor literature reference are given. Synonyms have usually not been included for recently revised taxa as complete synonymy is readily available within the appropriate cited revision. However, names that have recently been placed into synonymy or that are based on specimens with Canadian type localities are listed in the synonymy. Synonymy is listed in more detail, but not exhaustively, for groups that have not received recent taxonomic attention. A trend in taxonomy is for larger genera to be broken up into smaller, more narrowly defined genera. The larger, classical dytiscid genera have not been immune to this process and as a result the generic assignment of some species has changed recently. An author's name in brackets indicates that the generic assignment of a species has changed subsequent to its original description. The term "new combination" in the literature citation indicates where we are responsible for changing the generic placement of a species. A complete bibliography for each species is not included but selected references on nomenclature, morphology, and/or ecology are presented and these should serve as access to the available literature on the species.

Descriptions

Descriptions are nested, that is character states common to all taxa of one rank are treated in the description of the taxon at the next higher rank. Therefore the characters given in each description are those of value in taxon recognition. Characters used in the keys are repeated in the descriptions.

Information within descriptions is arranged in the following sequence: general appearance (size, shape, color, sculpture and vestiture); structural features from anterior of body to posterior and dorsal surface then ventral surface and legs; and sexual characters. Descriptions are rather lengthy but are justified because great similarity between many species makes their identification difficult. Larval and adult stages are treated in separate sections. This is done because different suites of characters are used in larval and adult classification and that by treating larvae and adults in separate sections, comparisons of the respective stages between taxa is facilitated. Characters and terminology for adults and larvae are described separately below.

Comments

A comments section includes such topics as problems in nomenclature, definition and recognition of taxa or discussions of relationships. This section is not included for all taxa but rather is used when problems have been noted or when changes in classification appear needed or have been introduced.

Ecology

Very little is known about the habitat, life history, or habits of most North American water beetles. Therefore this section contains available published information on ecology as well as our and other collector's observations on habitat. Data on seasonal distribution, occurrence of teneral specimens, and flight records are also presented as these data give evidence regarding life-history patterns.

Distribution

Maps indicating Canadian and Alaskan collection localities are given for each species. These records are based on specimens housed in the collections listed in the acknowledgements section and examined by us, published records, or records communicated by experienced collectors. Distribution in the conterminous United States is indicated by state records plotted as dots on the insert map. Records for small areas (e.g., District of Columbia, Rhode Island) are mapped with the adjacent larger states (e.g., Maryland, Connecticut) and Michigan is mapped as two separate entities (Upper and Lower Peninsula). Some of these records are based on published information in revisions or in detailed regional faunal works but in the case of the faunal works only records for species that are unambiguously identified were accepted. The principal faunal studies that we have consulted are:

Regional studies:
- Canada and Alaska (Larson and Roughley 1991)
- Pacific Northwest (Hatch 1953)
- Northeastern United States (Downie and Arnett 1996)

Canadian studies:
- Alberta (Larson 1975)
- Manitoba (Wallis 1973)
- Newfoundland (Larson and Colbo 1983)
- Yukon Territory (Larson 1997*b*)

United States studies:
- Alabama (Folkerts 1978)
- California (Leech and Chandler 1956; Challet and Brett 1998)
- Florida (Young 1954; Epler 1996)
- Indiana (White *et al* 1985)
- Kansas (Huggins *et al.* 1976; Slater 1979; Coler and Slater 1982)
- Maine (Malcolm 1971; Boobar *et al.* 1996)
- Nevada (LaRivers 1951; Anderson 1985)
- North Carolina (Brigham 1982)
- North Dakota (Gordon and Post 1965)
- South Carolina (Brigham 1982)
- Utah (Anderson 1962, 1985)
- Virginia (Michael and Matta 1977)
- Wisconsin (Hilsenhoff 1992, 1993*a, b, c*, 1994, 1995)

BIOLOGY

Adaptations to Aquatic Life

The common name, predacious water beetle, reflects the fact these insects are largely aquatic. The adaptive zone of members of the family is that of a predator that moves up and down through the water column. The active stages of all known North American species are aquatic and this applies to the world fauna as a whole with the exception of certain genera of minute beetles that have been collected from rainforest leaf litter and soils in mountainous areas of the Indian subcontinent and northeastern Australia (Brancucci 1985*a, b;* Watts 1982; Balke and Hendrich 1996).

Water beetles are essentially terrestrial insects that have acquired a suite of adaptations that enable aquatic existence. The terrestrial legacy is reflected in their respiration, for they are basically air-breathers. Both adults and larvae may be conspicuous on their trips to the water surface to obtain air. Beetles have an air reservoir beneath the elytra into which the abdominal spiracles open. Air from this subelytral space is exchanged as the beetle hangs head-down from the surface film when a continuous air passage is provided to the subelytral space by hydrofuge setae on the apical abdominal terga. Larvae also exchange air by hanging head-down from the surface but in their case, the air reservoir is the internal tracheal trunks. The lateral abdominal spiracles are closed in instars I and II but open in instar III in preparation for terrestrial respiration. Many larvae and the adults of certain small species or those living in swiftly flowing water seldom if ever surface to respire. Presumably, they obtain air by capturing bubbles on the substrate or through cuticular exchange of gas, for example across the elytra (Smrz 1981). Larvae of only one American genus, *Coptotomus*, have gills. Adults may use a physical gill produced by carrying a bubble on the hydrofuge hairs at the tip of the abdomen, across which O_2 diffuses from the water and CO_2 from the subelytral space into the water along concentration gradients. Such a physical gill is not permanent, lasting only so long as the bubble which must be replaced, but it augments O_2 supplies and probably contributes significantly to the duration of periods of submergence, especially when activity is low.

In addition to the respiratory adaptations, there is a suite of other features that enable the insects to lead an active aquatic life. Among beetles, dytiscids are notable for their rather uniform body form. Most are of a decidedly streamline shape being oval in lateral outline and somewhat dorsoventrally flattened. However, some are almost globose in shape whereas others are elongated and variously flattened. Generally the body is rather rigid: the head is deeply set into the prothorax which in turn broadly contacts the base of the elytra. Stiffening is further provided by the prosternum which is prolonged between the procoxae and in most species is received by a fork-like mesosternum and its apex by an impression in the metasternum between and behind the mesocoxae. This arrangement permits vertical movement of the forebody but almost no lateral flexing. Body form is probably constrained by hydrodynamic considerations as well as propulsion mechanisms.

The relationship between body form, swimming and hydrodynamics has intrigued a number of investigators (Nachtigall 1961, 1974; Ribera and Nilsson 1995; Ribera *et al.* 1997). Nachtigall (1961, 1974) focussed on larger species of the subfamily Dytiscinae which constitute the fastest swimmers among beetles. He identified dorsoventral flattening of the body, posteriorly placed metacoxae and shortened and broadened hind legs with increased leg surface as adaptations that increase swimming efficiency and stability. Ribera *et al.* (1997) examined the swimming behaviour of beetles of a variety of sizes and body forms and related these to velocity and manoeuvrability. For example, globular species predicted to have high manoeuvrability swam in highly sinuous trajectories across a wide range of speeds. However, some aspects of body form need to be interpreted in other ways than simple hydrodynamics. For example among smaller dytiscids, many have very coarse surface sculpture and/or setae and the body is short and globose, both features that would seem nonadaptive to a swimming animal. Wolfe and Zimmerman (1984) considered these characteristics in the Hydroporinae and concluded that the boundary layer of water around swimming hydroporines is so thick that surface sculpture features lie within it and that the beetle is hydrodynamically smooth regardless of microsculpture features. In respect to setae, these authors suggested they function to hinder backflow in the boundary zone. They suggest that whilst a globose body may be less stable than a streamlined one, it also offers greater manoeuvrability (supported by the experimental results of Ribera *et al.* 1997) which may be advantageous in certain habitats such as flowing water. However, many globose species also occur in lentic habitats.

Not all water beetles are strong swimmers and for these hydrodynamic streamlining is not important, rather other factors are probably more significant in influencing body form. Some species typically occur in gravel or under rocks. These tend to have flattened, parallel-sided bodies and in some (eg. *Agabus cordatus* LeConte) the pronotum is narrowed basally and the prosternal process shortened, modifications that increase the flexibility of the forebody presumably aiding the insect in crawling under or between rocks. Species that live in dense vegetation or debris may have similar form.

Surface sculpture of the body is highly varied. The range of surface sculptures varies from smooth and polished to variously reticulate or punctate, glabrous to setose, irregularly grooved or with deep regular grooves. Possible but as yet unproven functions of such sculpture include: smooth surfaces to decrease hydrodynamic resistance; coarsely sculptured or setose surfaces to hold a thick boundary layer of water that in turn reduces drag in swimming; species specific sculpture may assist in recognition of conspecifics and sexually dimorphic sculpture may be a mechanism by which males recognize conspecific females. Regardless of its biological role, this variation in sculpture is a boon to taxonomists.

Swimming is effected by simultaneous sculling of the hind legs. The metacoxae are fused to the body wall so that they can not rotate. Thus hind leg mobility is restricted in the vertical plane but they can swing through a large arc in the longitudinal axis. The metatibia and metatarsomeres are variously fringed with setae which increase the surface area of the "oar blade" on the back stroke but which fold against the leg and these outer leg sections in turn trail the tip of the femora on the forward stroke reducing leg drag. Not all dytiscids are strong swimmers and this is reflected in the structure of the hind legs. The strongest swimmers have broad leg segments whereas species that scramble through vegetation or occur under cover have slenderer legs, often with reduced natatorial setae. The limited mobility of the hind legs makes these insects awkward on land although some of the species with the least modified hind legs can raise their body on them and walk quite efficiently.

Larvae of many dytiscids have a specific gravity greater than that of water and therefore occur on the substrate when not actively swimming. However, Dytiscinae larvae are buoyant and tend to float at or near the surface and must grasp onto subsurface structures to remain submerged. The range of larval life styles includes burrowing, creeping, actively swimming and even floating and pelagic (Balduf 1935). The larva of *Matus* has broad protibiae which it apparently uses to burrow through soft substrates; the pale larvae of *Celina* and *Hydrovatus* inhabit the soft muck amongst the roots of aquatic plants. Creeping larvae move primarily by scrambling over the bottom or on vegetation. However larvae of all species can swim through sculling with all legs and some have natatorial setal fringes on the legs that make them efficient swimmers. The larvae of aciliines are pelagic and feed on zooplankton while swimming in the water column. These, as well as larvae of some other forms, have an escape mechanism achieved by a rapid reflexion of the abdominal apex which propels the insect in a short burst of speed.

Dytiscids move into the interface between air and water to breath, and through it in movements between land and water associated with pupation, overwintering or dispersal flight. For insects the size of the largest dytiscids, the water surface film is probably not much of a barrier but for small insects it offers a formidable obstacle. For the most part, the beetle cuticle is wettable and the beetles slip through the surface film. This can be seen in respiring beetles in which the body largely remains wetted with only the apex of the abdomen dry during replenishing of air reserves. However, after a beetle has been out of the water for some time, the nature of its cuticle changes to become hydrophobic. A beetle in such a state, when placed in water becomes trapped in the surface film. Brancucci (1977) has described how small beetles can use the surface film to obtain leverage to pull themselves under water. Dettner (1985) demonstrated surfactant chemicals in pygidial gland secretions which can be smeared over the body to wet the cuticle and aid the beetle in slipping through the surface film.

Once under water, the beetles usually maintain a slight positive buoyancy. This they do within the fixed hull dimensions of the outer body surface and in spite of varying gut fullness and changes in the size of fat body, gonads and even flight muscles. Buoyancy is controlled by the size of the subelytral air space which in turn can be varied by movement of the abdominal terga which form the floor of the air space. An abdomen full of food, fat body or eggs bulges the terga into the airspace and reduces its volume reducing buoyancy. Beetles with a more or less empty abdomen have a problem though for their overall body density is low and there are no muscles that can curve the terga up into the airspace to reduce its volume. They increase their density by ingesting water and storing it in an extensible diverticulum or ampulla in the rectum (Hicks and Larson

1991). This rectal ampulla can be expanded with water to fill most of the abdomen and through ingestion or expulsion of water can be used to adjust the trim of the diving beetle. This mechanism also allows a swimming beetle of relatively high density to leave the water, expel the water from its gut and thus reduce its overall body weight in preparation for flight. On reentering water, drinking would restore weight and allow buoyancy adjustment.

Life History Patterns

Adults and larvae of dytiscids are often very abundant in some habitats. They are undoubtedly an important component of the aquatic food web, not only for fish but also for aquatic and shore birds. Adults are often collected in numbers during ecological studies of various aquatic habitats. Despite their abundance and varied ecological roles, very few ecological or life history studies have been published for North American species. Much of our knowledge is inferred from European studies. Perhaps one reason for this is that identification previously has been difficult. An excellent model for future studies is that provided by the work on *Dytiscus alaskanus* Balfour-Browne published by Aiken (1985*b*, 1985*c*, 1986*a*, 1986*b*, 1992), Aiken and Khan (1992) and Aiken and Wilkinson (1985).

The life history of only a small proportion of species is known but in all it follows a similar pattern of egg, three larval instars, pupation, usually in an earthen cell above the water line, and the adult stage. Variation in life histories occurs primarily in the seasonal timing of dormancy which determines the overwintering stage and adult dispersal and mating. Hilsenhoff (1986) and Nilsson (1986*a*) discussed life history patterns in the Agabini and these patterns probably apply well to most if not all northern and temperate species. The five patterns identified by Nilsson (1986*a*) are:

1. univoltine spring breeders that have summer larvae and overwinter as adults;
2. univoltine species that breed during summer and overwinter as eggs;
3. semivoltine spring breeders that pass the first winter in the egg stage and the second winter as adults;
4. semivoltine summer breeders that pass the first winter as larvae and the second winter as adults;
5. species with flexible reproductive periods overwintering as larvae and adults.

Nilsson (1986*a*) related these life history patterns to seasonality and productivity characteristics of the habitat.

These various patterns are determined by variation in the relative length of time spent in each life history stage. This variation can be related to habitat characteristics, especially features that influence the length of time and seasonal timing of when the habitat is suitable for insect activity and growth. In Canadian latitudes, winter with freezing of aquatic habitats and spring snow melt are the factors to which virtually all species have adapted their life cycle. In lower latitudes, rainfall seasonality exerts the dominant control on life history patterns (Garcia *et al.* 1990; Larson 1997*c*).

Most species are univoltine, a few are semivoltine and there is circumstantial evidence of some species having two generations in a given year (e.g., *Laccophilus maculosus* Say, Hilsenhoff 1992). *Eretes sticticus* (L.), which occurs in temporary pools of arid regions, has a very short development time of 15 days (Kingsley 1985) and could potentially complete a number of generations per year. The most common life history pattern consists of adults overwintering, mating and ovipositing in the spring and the larvae completing development in spring to early summer, followed by pupation and adult emergence; some species with this pattern may mate in the fall (Aiken 1985*c*).

Fewer species overwinter in the larval stage. Some species overwinter in two stages, e.g., diapausing eggs and adults (some *Agabus*), or instar 3 larvae and adults (*Ilybius*, some *Agabus* and *Rhantus*). No species is known to overwinter in the pupal stage and, in general, the pupal stage is a highly vulnerable stage of short duration in the life history. Garcia *et al*. (1990) recorded summer diapause in adult *Agabus disintegratus* (Crotch) in California, a region where habitat dries up in the summer and beetle breeding occurs in the winter. Larson (1997*c*) recorded high densities of non-breeding beetles in available water during the dry season in tropical Australia and with the advent of the wet season many species dispersed into newly formed habitat for breeding.

Mating in most species apparently occurs shortly before oviposition. However, Aiken and Wilkinson (1985) observed that most mating in *Dytiscus alaskanus* occurred in late summer and fall whereas eggs were laid the following spring. During copulation the male grasps the female by means of the front and middle legs. Various parts of the male legs may be modified to assist the male in holding onto the female's back. Modifications include the presence of various types of adhesive vestiture on the ventral surface of the pro- and mesotarsomeres, modified or toothed protarsal claws and emarginate tibiae and femora. Mating may last for only a minute or two up to two or three days. During mating a spermatophore, containing sperm, is transferred from the male to the female. Sperm is stored in the spermatheca of the female and released as the mature egg passes down the oviduct.

Eggs are deposited in a variety of ways which range from being scattered on the substrate to attached to aquatic vegetation to being inserted into plant tissue. Although dytiscid beetles are quite uniform in external appearance, females possess a wonderful diversity of ovipositor forms (Böving 1913). Basically the ovipositor is made up of a pair of gonocoxae which may be variously modified. These various ovipositor types may function as saws, swords or spears to cut slits into vegetation for endophytic oviposition, may be like pries for inserting eggs into debris or crevices, or may be in the form of flexible tubes for positioning eggs into small spaces. In spite of this range of specialized ovipositors, oviposition behaviour in a given species may still be quite labile for females with simple ovipositors may bite holes into plant stems in which eggs are laid, or females with piercing or slicing ovipositors may lay eggs into crevices or in the open.

Fertilized eggs hatch into larvae which undergo three instars before leaving the water to pupate in a terrestrial cell. Eggs of most species require 6-8 days for embryological development although eggs of some species adapted to temporary habitats may hatch in as few as 3 days. Development times of up to 6 weeks are known for eggs of species of *Dytiscus* under very cool conditions. The eggs of some species of Agabini may undergo a diapause and not hatch until the following spring, almost a year after they were laid (James 1970; Nilsson 1986*a*).

Instar 1 larvae are characterized by the presence of two egg bursters or hatching spines on the head and a simple set of setae (primary setae) on the body. Instar 2 larvae lack egg bursters and have additional setae (secondary setae) and lack functional spiracles on all but the last abdominal segment. Instar 3 larvae are larger, have increased numbers of secondary setae and possess functional spiracles on many abdominal segments. Instars 1 and 2 are passed relatively quickly and may represent only a quarter to half of the time spent in the larval stage (Kingsley 1985). A greater proportion of time is spent in instar 3, especially by species with larger adults. It is in instar 3 that most weight gain and preparation for pupation occurs.

When fully grown, instar 3 larvae leave the water to pupate. Pupation occurs in cells constructed relatively close to the water (e.g., a few centimetres up to several metres). The larvae move away from the water until they encounter an obstacle or shelter such as a stone, board, clump of vegetation or fallen leaves. Construction of the pupal cell may be as simple as the larva using body contortions to form a chamber by compressing the surrounding soil. However, some species may use their mandibles to construct a cell from particles (Matheson 1914). The pupae lies on its back within the pupal cell, suspended above the cell floor by elongate setae. The pupal stage is generally of short duration. However after eclosion, the teneral adult may remain in the pupal cell for a considerable time before returning to the water.

Flight is an important aspect of dytiscid life history. It is used to colonize new habitat, to find overwintering sites and to leave habitats that are changing or drying up. Most water beetles fly or seem to have the capacity for flight sometime during their adult life. Only within two Canadian species, *Liodessus flavicollis* and *Agabus bifarius*, is wing reduction known. However, flight muscle reduction may occur in specimens with long wings so the presence of fully developed wings need not always imply flight capability (Jackson 1952, 1955). The ability to fly may vary depending upon species, season and between populations (Bilton 1994*a*). Some species remain capable of flight throughout adult life whereas others emerge with potentially functional flight muscles which are then resorbed later in the season (Bilton 1994*a)*. Data presented by Spangler and Gordon (1973) for *Agabetes acuductus* indicates a population capable of flight within a species that does not normally fly. Water beetles fly both during daylight hours and at night. The day-flying beetles are often attracted to shiny surfaces such as cars, plastic or wet pavement presumably because the reflectance resembles that from water; night flying species often come to light.

Dispersal strategies are not well understood. Likely, species inhabiting vernal ponds disperse in the spring and probably during hours of light because of the long day lengths and cool evenings in Canadian latitudes at this time of year. Species living in permanent habitats seem to disperse in summer and fall, and generally at night. Garcia *et al.* (1990) concluded that dispersal in *Agabus disintegratus* occurred at the most optimal period for finding natural water sources. Some species may track habitat, that is leave drying ponds for watered sites in summer and fall and return to the temporary ponds after they have refilled the next spring (Hilsenhoff 1986). This migratory behaviour is certainly apparent in low latitudes but not evident over most of Canada. Some species are true colonizers, the adults dispersing readily and likely to be encountered in almost any type of water body. Such species may appear to be almost ubiquitous in a fauna but this belies more restricted larval requirements. Fernando (1958), Fernando and Galbraith (1973), Wiggins *et al.* (1980) and Larson (1997*c)* have documented the colonization of newly formed habitat and subsequent changes in faunal composition as the habitat matured as was also noted by Aiken (1991). Species that occur in mature, stable habitat are less prone to disperse for many of these have seldom, if ever, been collected in flight.

Intraspecific Relations

Conspecific dytiscid beetles probably interact in a variety of ways but little is known of this behaviour. Intraspecific competition for food may or may not be a regular feature of their ecology but group feeding, which is similar to competition but probably advantageous by allowing beetles to consume larger prey items than would be possible for an individual to handle, has been described by Smith (1973). These "feeding frenzies" are probably widespread among, at least, the larger dytiscids as they have been observed in many species held in aquaria.

Courtship behaviour is typically simple. Smith's (1973) description of behaviour in members of *Rhantus* and that of Aiken (1992) and Aiken and Khan (1992) for members of *Dytiscus* is representative. When a male encounters a female, recognition seems to depend upon contact. The male rapidly tries to clasp the female but if unsuccessful a brief chase may ensue ending with the female escaping. In *Rhantus* the male clasps the female by hooking his pro- and mesotarsi on the underside of the female prothorax and affixing his protarsal suckers onto the dorsal surface of the female. Male specimens of *Dytiscus* catch the female in a kind of arm lock between the femur and tibia before placing the highly specialized tarsi onto the dorsal surface of the female. Differences in surface sculpture between species and between sexes may have a role in species and sexual recognition. Also, differences in male protarsal claw form and adhesive vestiture of the pro- and mesotarsi likely aid in ensuring conspecific mating. Male genitalia often differ only minorly between related species so that it seems genitalic incompatibility is not a primary mechanism preventing interspecific matings. Although found on only a minority of dytiscid beetles, cuticular structures of possible stridulatory function (Larson and Pritchard 1974) as well as setal brushes occur on diverse parts of water beetle bodies. Most of these structures are present or best developed on males and are therefore likely to be associated with species specific courtship behaviour but to date no relevant behavioral observations have been made. Aiken (1985*a)* has reviewed sound production in Dytiscidae, basically concluding its source and function is inadequately understood.

Little is known about the population ecology or structure of dytiscid beetles. Bilton's (1992, 1993, 1994*b)* studies of a European species, *Hydroporus glabriusculus*, demonstrate that although this species shows a low degree of structural differentiation between populations, electrophoretic analysis suggests that many of these populations had been isolated from each other for thousands of years and that there was very limited gene flow among subpopulations even within the same habitat. It would be useful to investigate whether this is a common pattern amongst dytiscids or an exceptional situation. Evidence from a tropical fauna indicates that certain species are highly vagile and can track seasonal or unpredictable habitats whereas others are very sedentary (Larson 1997*c)*. This pattern probably applies to all faunas although the relative percentage of species of each type probably varies depending upon climatic factors and habitat stability and predictability.

Ecological Role of Dytiscid Beetles

All dytiscid beetles are carnivorous, at least in part, and the larvae appear to be exclusively so. Deding (1988) made an extensive study of the gut contents of Danish dytiscid beetles and found that all contained animal material in their guts, but some beetles, especially those of the larger species, contained significant amounts of plant material. Deding concluded that plant material occurred in too great of quantities to be due to incidental ingestion and that it represented a supplement to the animal diet. However, more detailed studies are required in order to demonstrate nutritional value obtained from ingested plant material. Hicks (1994) investigated the gut contents of field collected adults of several *Ilybius* species and concluded that they were generalist predators. In the laboratory they also fed as scavengers when offered dead prey and instances of cannibalism were observed.

Adults are rather clumsy in their movements and seem on casual observation to be rather inept at capture of active prey therefore they may be principally scavengers feeding to a large extent on dead or injured animals (Johnson and Jakinovich 1970, Hicks 1994) although other investigators consider them predators (Idecker 1979). It is common to find one or more beetles feeding on a dead earthworm or terrestrial insect and such food items are readily attacked when presented to beetles both in aquaria and under natural conditions. Live prey detection is probably through physical contact although a beetle in the vicinity of physically damaged prey will become excited in its actions indicating chemical sensitivity to prey body fluids. Vision and water borne vibrations may also be used by beetles for prey location. *Agabus tristis* adults have been observed in alpine lakes of the Rocky Mountains feeding at the surface by seizing insects floating in the surface film (Larson, unpublished). Similar surface-feeding behaviour has been reported for *Rhantus* spp. (Smith 1973).

Larvae, on the other hand, are effective predators. Prey is probably detected through tactile cues although some forms are visual hunters. For example, the larvae of aciliines are pelagic, feeding on small prey that they presumably locate and strike at with the aid of very large, anteriorly directed stemmata. There is little indication of prey selection other than it be of the appropriate size range and available (Deding 1988). Unlike adult beetles, most larvae (except *Copelatus*) ingest liquid food. Prey is seized with the canaliculate mandibles and through preoral enzymatic digestion, the soluble internal parts are reduced to a liquid state and ingested (Barman 1972). Thus, the mouth opening is closed. This is presumably an adaptation which reduces the amount of water ingested in feeding and reduces food loss into the water.

Larval prey varies from microcrustacea captured out of the water column (aciliines) or on or near the bottom, through various insect larvae to small fish (Wilson 1923), amphibians (Holomuzki 1986) and even reptiles (Drummond and Wolfe 1981). The structures of the elongated nasale and apically up-curved mandibles of hydroporine larvae appear to be adaptations to capturing and handling microcrustacea in a trifid apparatus (Matta 1983). Colymbetines feed mainly on other aquatic insects, especially Diptera larvae whereas the larger Colymbetines and non-pelagic dytiscines are generalist predators taking any prey of suitable size although some prey specialization may exist, e.g., syntopic *Dytiscus harrisii* prey on case-bearing Trichoptera and *D. verticalis* on tadpoles (Leclair *et al.* 1986). Dytiscids that co-occur with mosquito larvae prey on them (James 1966) but it is not known how significant this predation is in controlling mosquito numbers. In northern Canada where both mosquitoes and dytiscids are abundant one has to conclude dytiscids are not effective enough! Two factors may be involved here. Dytiscids and mosquito larvae are often not in exactly the same habitat, perhaps because of dytiscid predation pressure on mosquitos (Larson and House 1990) or in certain temporary habitats prey is so abundant as to overwhelm predators which because of different life histories never can achieve the same sorts of density as the more opportunistic prey.

A life-time energy budget has not been compiled for any dytiscid species so that the relative energetic role of each stage is not known. It appears as though larval feeding is used primarily for growth and metamorphosis into the adult stage. The newly emerged adult usually has little fat body and immature gonads, these being developed by adult feeding. However, teneral specimens frequently occur at light so that in at least some species it is probable that material sequestered in the larval stage is used in adult activities.

Although beetles are afforded at least some protection by hard cuticle, a smooth hard to grasp shape, and defensive secretions, the insects are still subject to predation. Peddle and Larson (1999), through analysis of cuticular damage of larger water beetles, concluded that many individuals had experienced attacks by what were probably vertebrate predators. Beetles showing higher prevalence of injury were those from lower latitudes and larger species that occurred in more open habitats. This study could not determine if beetles were attacked and escaped or if they were rejected by predators. Nevertheless it did indicate that habits of the beetle and geographical region influence predation pressure.

Color pattern also provides indirect evidence that predation by visually hunting predators, vertebrates, is important. Young (1960*c)* noted a tendency for water beetles from desert regions to be brightly colored and strongly patterned. Galewski (1971) also noted a similar trend amongst beetles living in habitats with sand or gravel bottoms. Larson (1996*a)* showed that convergence in bright color pattern occurred among unrelated taxa occupying similar desert stream environments. In this habitat, there are few plants amongst which beetles can hide, rather they spend considerable time on the bottom and bold color patterns break up the body outline and render the beetle less conspicuous. In contrast, beetles from densely shaded habitats or those with dark substrates or dense vegetation tend to be darker in color (Balke *et al.*1997).

Predation is probably more intense in the larval stages which have fewer defences than adults. Predation on larvae, along with seasonal habitat variability, is probably an important reason why larval stages are of short duration. Beetles and larvae are scarce or absent from habitats with populations of insectivorous fish. Also, beetle populations are negatively correlated with those of larval dragonflies, the other important group of aquatic insect predators (Larson 1990*a)*. In Canadian latitudes, fish distribution depends upon the existence of free water with adequate winter O_2 levels; odonates generally require sites that do not freeze solidly or dry up; whereas dytiscids can cope with both winter freezing and summer drying. Thus, there is a dominance hierarchy of predators from fish in deeper, permanent water, to odonates in permanent shallower water, to dytiscids in shallow, often temporary or fluctuating habitats.

The terrestrial pupal stage is also subjected to predation from a variety of insect predators such as carabid and staphylinid beetles and ants. In addition, because the pupae are located close to the water edge, fluctuations in water levels can result in mortality through excessive drying or flooding. Dytiscid beetles are attacked by a variety of parasites which include mites (Aiken 1985*b)*, parasitic wasps (Jackson 1958, 1964; Mason 1968) and fly maggots (Chilcott and James 1966) as well as members of other phyla.

Water beetles may also affect the community of microorganisms with which they occur. When dispersing beetles collected at light are handled, some exude a few drops of water. This suggests that dytiscids may be capable of transporting algae, protozoa and other micro-organisms between aquatic habitats. Potential sources for the inoculum include water held within the rectum, gut contents, feces, as well as material on the cuticle of the beetle. This role is known for other aquatic insects (Stewart and Schlichting 1966) and other aquatic beetles (e.g., Hydrophilidae, Milliger and Schlichting 1968) but has not yet been confirmed for dytiscids.

Community Ecology

Various degrees of habitat specificity have been observed among dytiscid beetles. As with most large groups of organisms, some species are eurytopic, that is are widespread and occur in a wide range of habitat types, whereas others are stenotopic and occur only in a specific habitat. Many authors have qualitatively described the habitats of various dytiscid species and a few authors have attempted to quantify these relations. Generally, environmental factors important in habitat selection of the various species are not very well known. Habitat features such as permanence, size, temperature, exposure, plant abundance, substrate type, water movement, neighbouring terrestrial vegetation, occurrence of other types of animals in the habitat, and water chemistry, can be correlated to the distribution of various species.

Almost no dytiscid beetle species occurs alone as the sole representative of the family in a habitat. Rather, habitats that have one species usually have more and in some cases a body of water may have a very diverse community with up to 50 species having been found in one Alberta boreal pond-marsh system. Many species occur together in certain habitat types so that it is possible to refer to them as representing a community that can be defined probabilistically. Why these multispecies communities exist has been of considerable interest to ecologists. Obviously within any given habitat there are many habitat subdivisions so that many of the species in the habitat can find themselves niches separated to greater or lesser degree from that of co-occurring species. For example *Liodessus* and *Dytiscus* species, which differ by about 4 orders of magnitude in body volume, certainly occupy very different habitat zones and use different resources. However, within many habitats more than one species of a given size range, and usually of the same genus and therefore similar body form, co-occur. The question is do they interact or compete? Larson (1985) showed that congeneric beetles that show high patterns of concordance in distribution do tend to occupy slightly different ranges of habitat indicating somewhat different environmental responses. Juliano and Lawton (1990*a*) looked at body form distribution in several habitats and saw little evidence for widely spaced body forms that would reduce competition in some sites but evidence of pattern in others. Juliano and Lawton (1990*b*) could not show competition for food between adults but larvae showed density dependent survival in manipulated field enclosures.

Analysis of water beetle communities has been undertaken by a number of workers, some of the more recent and quantitative studies being those of Larson (1985, 1997*c*), Ranta (1985), Cuppen (1986), Eyre *et al.* (1986), Lancaster and Scudder (1987), Foster *et al.* (1990), Lillie (1991), and Nilsson *et al.* (1994). In general these studies have shown that repeatable assemblages of water beetle species do exist and that these can be related to rather generally defined habitat characteristics, principally water flow, permanency, size of habitat, substrate type, vegetation, temperature, acidity, and salinity. Larson (1987) and Roughley and Larson (1991) have discussed water beetle faunas of particular habitat types within Canada. Eyre and Rushton (1989) and Foster *et al.* (1990) have demonstrated the value of water beetle community analysis in habitat conservation and management. These analyses have demonstrated that robust habitat classifications can be produced with data consisting of little more than fairly complete species lists and from these classifications considerable information can be inferred on factors such as impacts of various human activities on historical changes (Foster 1992). Although little used to date in North America, analysis of water beetle communities has great potential for understanding, managing and protecting lentic habitats (Young 1961).

Nature of Canada's Dytiscid Fauna

Canada has about 276 species of dytiscid beetles (Table 1). The uncertainty in number of species in a book that purports to provide a comprehensive survey of the fauna may seem somewhat unusual. However there are three main reasons why only an estimate of the total species count can be made at this time. First, it is almost certain that additional species occur within the area and have yet to be discovered. Within several species complexes, such as the *Hydroporus nigellus* complex or *Sanfilippodytes*, differences between species are slight and it is likely that with more study, species will be defined more narrowly and additional species recognized. For example, Fery and Nilsson (1993) recently recognized a species of *Agabus*, *A. larsoni*, on the basis of slight but consistent differences in the width of the apex of the male aedeagus. Such new taxa may be discovered in any group when examined in detail for even genera considered to be well known have proven to contain unrecognized species. The small genus *Acilius*, which contains moderately large, well collected species, has had two widespread and distinctive species described fairly recently. The discovery of unrecognized species within well known genera occurs frequently enough that a rule of taxonomy may be suggested - if a species is distinctive and easily recognized and therefore assumed to be well known, the chances are it is not well known. Species considered easily recognized are often not studied critically.

Secondly, there are probably still a few uncollected and undescribed species. One of the most distinctive species of hydroporines in the fauna, *Stictotarsus minipi*, is still known from only the type specimen from Labrador, an area not known for its endemism thus the species is likely to be of wider distribution. *Agabus margaretae* and *Sanfilippodytes bertae* are known from only a few specimens from the southern Prairie provinces. These are species of specialized habitats and with more intensive investigations it is likely additional ecologically specialized species will be discovered. Although human transport has had no evident effect on the Canadian fauna, many dytiscids have excellent powers of dispersal and several species in the faunal list are represented by specimens that are almost certainly adventitious, such as *Neoclypeodytes cinctellus* and *Stictotarsus aequinoctialis*. More adventitious species will be discovered with intensive collecting near the United States border.

The third reason for uncertainty about the number of species in the fauna lies in the fact that the limits of some species are not understood. All species show some degree of morphological variation. If the variation occurs within a population or within a small area it is considered to represent individual variation and is encompassed within the species definition. However there is often a geographical pattern to the variation. For example in *Hydroporus notabilis*, specimens from the north are smaller than those from more southerly localities and size increases in a fairly regular way from north to south. This variation follows a gradient in ecological conditions and represents the species' response to its environment, that is the variation is ecotypic and is not considered a basis for recognition of formal taxa. Microecotypic variation exists in color of some species for often specimens of *Hydroporus signatus* and *Heterosternuta pulcher* have more extensive pale markings when occurring on paler substrates than specimens living in habitats with darker substrates and although the specimens may be of quite different appearance, they are not treated as taxonomically separate entities. Larson (1994*a)* noted that some species of *Agabus* occurring in more extreme habitats (e.g., northern, alpine or highly unstable habitats) are those that show the highest amount of intraspecific variation in body size. Patterns of variation over larger geographical scales are more difficult to handle taxonomically. For example, within Canada there are eastern and western forms within the *Laccophilus maculosus*, *Nebrioporus rotundatus*, and *Coptotomus longulus* complexes. Within each of these complexes the eastern and western forms are stable over a large geographical region but a relatively narrow transition zone occurs in Manitoba. Because intergradation occurs, the eastern and western forms in the *L. maculosus* and *C.*

longulus complexes are treated as subspecies. Hilsenhoff (1994) reported similar hybridization in the *Nebrioporus rotundatus* complex in Wisconsin but because we have not studied the situation in Canada we have followed the most recent revision of the group (Shirt and Angus 1992) and treat the geographical forms as separate species. *Agabus seriatus* was considered to show a similar pattern and was recognized as existing as eastern and western subspecies but an analysis of variation within the complex showed the variation in several characters was clinal and nonconcordant so that well defined subspecies did not exist (Larson 1997*a*). Further examination of such cases may show that fewer or more species than recognized in this work exist.

Table 1. Checklist of Dytiscidae of Canada and Alaska, with provincial records (0 - absent, 1 - present).

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
Subfamily COPELATINAE														
***Copelatus* Erichson**														
1. *chevrolati* Aubé	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2. *glyphicus* (Say)	0	0	0	0	0	0	0	1	1	0	1	1	0	1
Subfamily AGABETINAE														
***Agabetes* Crotch**														
3. *acuductus* (Harris)	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Subfamily LACCOPHILINAE														
***Laccophilus* Leach**														
4. *biguttatus* Kirby	1	1	1	1	1	1	1	1	1	0	0	0	1	0
5. *maculosus decipiens* Say	0	0	0	1	1	1	1	0	0	0	0	0	0	0
maculosus maculosus Say	0	0	0	0	0	0	1	1	1	1	1	1	0	0
6. *proximus* Say	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Subfamily HYDROPORINAE														
Tribe Laccornini														
***Laccornis* des Gozis**														
7. *conoideus* (LeConte)	0	1	1	1	1	1	1	1	1	1	0	0	0	1
8. *deltoides* (Fall)	0	0	0	0	0	0	0	1	0	0	0	0	0	0
9. *latens* (Fall)	0	0	0	0	0	0	0	1	1	1	1	0	0	0
10. *oblongus* (Stephens)	0	0	1	0	0	0	0	0	0	0	0	0	0	0
11. *pacificus* (Leech)	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Tribe Methlini														
***Celina* Aubé**														
12. *hubbelli* Young	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Tribe Hydrovatini														
***Hydrovatus* Motschoulsky**														
13. *pustulatus* (Melsheimer)	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Tribe Hyphydrini														
***Desmopachria* Babington**														
14. *convexa* (Aubé)	0	0	1	1	1	1	1	1	1	1	1	1	0	0
Tribe Bidessini														
***Bidessonotus* Régimbart**														
15. *inconspicuus* (LeConte)	0	0	0	0	0	0	0	1	1	0	1	0	0	0
16. *pulicarius* (Aubé)	0	0	0	0	0	0	0	0	1	0	0	0	0	0
***Liodessus* Guignot**														
17. *affinis* (Say)	0	0	0	0	0	0	0	1	1	1	1	1	0	1
18. *cantralli* (Young)	0	0	0	0	1	1	1	1	0	0	0	0	0	0
19. *flavicollis* (LeConte)	0	0	0	0	0	0	1	1	1	0	0	0	0	0
20. *fuscatus* (Crotch)	0	0	0	0	0	1	1	1	1	0	1	0	1	0
21. *noviaffinis* Miller	0	0	0	0	0	0	0	0	0	0	1	0	0	0
22. *obscurellus* (LeConte)	1	1	1	1	1	1	1	1	0	0	0	0	0	0
***Neoclypeodytes* Young**														
23. *cinctellus* (LeConte)	0	0	0	0	1	0	0	0	0	0	0	0	0	0
24. *ornatellus* (Fall)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
***Uvarus* Guignot**														
25. *falli* (Young)	0	0	0	0	0	0	0	1	1	1	1	0	0	0

Table 1. Continued

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
26. *granarius* (Aubé)	0	0	0	0	0	0	1	1	1	0	0	0	0	0
27. *lacustris* (Say)	0	0	0	0	0	0	0	1	0	0	0	0	0	0
28. *subtilis* (LeConte)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Tribe Hydroporini														
***Hygrotus* Stephens**														
29. *acaroides* (LeConte)	0	0	0	0	0	0	1	0	0	0	0	0	0	0
30. *bruesi* (Fall)	0	0	0	0	1	0	0	0	0	0	0	0	0	0
31. *compar* (Fall)	1	0	0	1	1	1	1	1	1	1	0	0	1	1
32. *dissimilis* G. & H.	0	0	0	1	0	0	1	1	1	0	0	0	0	0
33. *falli* (Wallis)	0	0	0	0	0	0	0	1	1	0	0	0	0	1
34. *farctus* (LeConte)	0	0	0	0	1	1	1	1	1	1	0	0	0	0
35. *impressopunctatus* (Schaller)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
36. *infuscatus* (Sharp)	0	1	1	1	1	1	1	0	0	0	0	0	0	0
37. *intermedius* (Fall)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
38. *laccophilinus* (LeConte)	0	0	1	0	1	1	1	1	1	1	1	0	0	0
39. *lutescens* (LeConte)	1	0	0	1	0	0	0	0	0	0	0	0	0	0
40. *marklini* (Gyllenhal)	1	1	1	0	1	1	1	0	1	0	0	0	0	1
41. *masculinus* (Crotch)	0	0	0	1	1	1	1	0	0	0	0	0	0	0
42. *nigrescens* (Fall)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
43. *novemlineatus hudsonicus* (Fall)	1	1	1	0	0	0	1	1	1	0	0	0	0	0
44. *nubilus* (LeConte)	0	0	0	0	0	0	0	1	1	1	1	0	0	0
45. *obscureplagiatus* (Fall)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
46. *patruelis* (LeConte)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
47. *picatus* (Kirby)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
48. *punctilineatus* (Fall)	0	1	0	1	1	1	1	1	0	0	0	0	0	0
49. *salinarius* (Wallis)	0	0	1	1	1	1	1	0	0	0	0	0	0	0
50. *sayi* Balfour-Browne	1	1	1	1	1	1	1	1	1	1	1	1	1	1
51. *sellatus* (LeConte)	0	1	1	0	1	1	1	1	0	0	0	0	0	0
52. *semivittatus* (Fall)	0	0	0	1	1	0	1	0	0	0	0	0	0	0
53. *suturalis* (LeConte)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
54. *sylvanus* (Fall)	0	0	0	0	0	0	0	1	1	0	0	0	0	0
55. *tumidiventris* (Fall)	0	0	1	1	1	1	1	0	0	0	0	0	0	0
56. *turbidus* (LeConte)	1	1	1	1	1	1	1	1	1	0	1	1	0	0
57. *unguicularis* (Crotch)	1	1	1	1	1	1	1	0	1	0	0	0	1	1
***Sanfilippodytes* Franciscolo**														
58. *bertae* Roughley & Larson	0	0	0	1	0	0	0	0	0	0	0	0	0	0
59. *brumalis* (Brown)	0	0	0	1	1	1	0	0	1	0	0	0	1	0
60. *compertus* (Brown)	1	1	1	1	1	0	0	0	0	0	0	0	0	0
61. *edwardsi* (Wallis)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
62. *pacificus* (Fall)	1	0	0	1	0	0	0	0	0	0	0	0	0	0
63. *planiusculus* (Fall)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
64. *pseudovilis* (Young)	1	0	0	1	1	1	1	1	1	0	0	0	1	1
65. *terminalis* (Sharp)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
***Heterosternuta* Strand**														
66. *allegheniana* (Matta & Wolfe)	0	0	0	0	0	0	0	0	1	1	0	0	0	0
67. *cocheconis* (Fall)	0	0	0	0	0	0	0	0	1	0	0	0	0	0
68. *pulcher* (Fall)	0	0	0	0	0	0	0	1	1	1	1	0	1	1
69. *wickhami* (Zaitzev)	0	0	0	0	0	0	0	1	1	0	0	0	0	0
***Neoporus* Guignot**														
70. *blanchardi* (Sherman)	0	0	0	0	0	0	0	0	0	0	1	0	0	0
71. *carolinus* (Fall)	0	0	0	0	0	0	0	1	1	1	1	0	1	1
72. *clypealis* (Sharp)	0	0	0	0	0	0	0	1	1	1	1	0	0	1

Table 1. Continued

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
73. *dilatatus* (Fall)	0	0	0	0	0	0	0	0	0	1	0	0	0	0
74. *dimidiatus* (G. & H.)	0	0	0	0	1	1	1	1	1	1	1	1	1	1
75. *mellitus* (LeConte)	0	0	0	0	0	0	0	1	1	1	0	0	0	0
76. *spurius* (LeConte)	0	0	0	0	0	0	0	1	1	1	1	0	0	0
77. *sulcipennis* (Fall)	0	0	0	0	0	0	0	1	1	1	0	0	0	0
78. *superioris* (Balfour-Browne)	0	0	1	1	1	1	1	1	0	0	0	0	0	0
79. *tennetum* (Wolfe)	0	0	0	0	0	0	0	1	0	0	0	0	0	0
80. *undulatus* (Say)	0	0	1	1	1	1	1	1	1	1	1	1	1	1
81. *vittatus* (LeConte)	0	0	0	0	1	1	1	1	0	0	0	0	0	0
82. *vitiosus* (LeConte)	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Hydroporus **Clairville**														
83. *appalachius* Sherman	0	1	1	1	1	1	1	1	1	0	0	0	1	0
84. *aurora* Larson & Roughley	1	0	1	0	0	0	1	0	0	0	0	0	0	0
85. *badiellus* Fall	1	1	1	1	1	1	1	1	1	1	1	0	1	1
86. *boraeorum* Larson & Roughley	0	1	1	1	0	0	1	0	0	0	0	0	0	0
87. *brevicornis* Fall	0	0	0	0	0	0	0	1	1	1	1	0	1	1
88. *carri* Larson	0	0	0	0	1	0	0	0	0	0	0	0	0	0
89. *columbianus* Fall	0	1	1	1	1	1	1	1	1	1	0	0	0	0
90. *dentellus* Fall	1	1	1	1	1	1	1	1	1	1	1	1	1	0
91. *despectus* Sharp	0	1	1	1	1	0	1	1	1	0	1	0	0	1
92. *dichrous* Melsheimer	0	0	0	0	0	0	0	1	1	0	0	0	0	0
93. *fortis* LeConte	0	0	0	1	0	0	0	0	0	0	0	0	0	0
94. *funestus* Fall	0	0	0	1	0	0	0	0	0	0	0	0	0	0
95. *fuscipennis* Schaum	1	1	1	1	1	1	1	1	1	1	0	0	1	1
96. *geniculatus* Thomson	1	1	0	1	1	0	0	0	0	0	0	0	0	0
97. *gossei* Larson & Roughley	0	0	0	0	0	0	0	1	1	1	0	0	0	1
98. *hirtellus* LeConte	0	0	0	1	0	0	0	0	0	0	0	0	0	0
99. *lapponum* Gyllenhal	1	1	1	1	0	0	1	1	1	0	0	0	1	1
100. *larsoni* Nilsson	1	1	1	1	1	1	1	1	0	0	0	0	1	0
101. *longiusculus* G. & H.	1	0	0	1	0	0	0	0	0	0	0	0	0	0
102. *mannerheimi* Balfour-Browne	1	1	1	1	1	0	0	0	0	0	0	0	0	0
103. *melsheimeri* Fall	0	0	0	0	0	0	0	1	1	0	0	0	0	0
104. *morio* Aubé	1	1	1	1	1	1	1	1	1	0	1	0	1	1
105. *nigellus* Mannerheim	1	1	1	1	1	1	1	1	1	1	0	0	1	1
106. *niger* Say	0	0	0	0	0	0	0	1	1	1	1	1	0	1
107. *notabilis* LeConte	1	1	1	1	1	1	1	1	1	1	1	1	1	1
108. *obscurus* Sturm	1	1	1	1	1	1	1	1	1	1	1	0	1	1
109. *occidentalis* Sharp	0	1	0	1	1	1	0	0	0	0	0	0	0	0
110. *pervicinus* Fall	0	0	0	1	1	1	1	0	0	0	0	0	0	0
111. *polaris* Fall	1	1	1	0	0	0	1	0	1	0	0	0	0	0
112. *puberulus* LeConte	1	1	1	1	1	0	1	1	1	1	0	0	1	1
113. *rectus* Fall	1	1	1	1	1	1	1	1	1	1	1	0	1	1
114. *rufinasus* Mannerheim	1	1	1	1	1	1	1	1	1	0	1	0	0	0
115. *sibiricus* Sahlberg	1	1	1	0	0	0	0	0	0	0	0	0	0	0
116. *signatus* Mannerheim	1	1	1	1	1	1	1	1	1	1	1	1	1	1
117. *similaris* Fall	0	0	0	1	0	0	0	0	0	0	0	0	0	0
118. *sinuatipes* Fall	0	0	0	1	0	0	0	0	0	0	0	0	0	0
119. *striola* (Gyllenhal)	1	1	1	1	1	1	1	1	1	1	1	0	1	1
120. *tademus* Leech	0	0	0	1	1	0	0	0	0	0	0	0	0	0
121. *tartaricus* LeConte	1	1	1	1	1	0	1	1	1	0	0	0	0	0
122. *tenebrosus* LeConte	1	1	1	1	1	1	1	1	1	0	1	0	1	1
123. *transpunctatus* Chandler	1	0	0	1	1	0	0	0	0	0	0	0	0	0

Table 1. Continued

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
124. *tristis* (Paykull)	1	1	1	1	1	1	1	1	1	1	1	0	1	1
Hydrocolus **Roughley & Larson**														
125. *persimilis* (Crotch)	0	0	0	0	0	0	0	0	1	1	1	0	1	1
126. *paugus* (Fall)	1	1	1	1	1	1	1	1	1	1	1	0	1	1
127. *rubyae* (Larson)	0	1	1	1	1	1	1	1	1	1	0	0	1	1
128. *stagnalis* (G. & H.)	0	0	1	1	1	1	1	1	1	1	1	1	0	1
Stictotarsus **Zimmermann**														
129. *aequinoctialis* (Clark)	0	0	0	0	1	0	0	0	0	0	0	0	0	0
130. *deceptus* (Fall)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
131. *griseostriatus* (DeGeer)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
132. *minipi* (Larson)	0	0	0	0	0	0	0	0	0	0	0	0	1	0
133. *spenceri* (Leech)	0	1	0	1	1	1	1	0	0	0	0	0	0	0
134. *striatellus* (LeConte)	0	1	1	1	1	1	1	0	0	0	0	0	0	0
Nebrioporus **Regimbart**														
135. *depressus* (Fabricius)	0	0	1	0	1	0	1	0	0	0	0	0	0	0
136. *macronychus* (Shirt)	0	0	0	1	1	1	1	1	0	0	0	0	0	0
137. *rotundatus* (LeConte)	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Oreodytes **Seidlitz**														
138. *alaskanus* (Fall)	1	0	0	1	0	0	0	0	0	0	0	0	0	0
139. *angustior* (Hatch)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
140. *congruus* (LeConte)	0	0	0	1	1	0	0	0	0	0	0	0	0	0
141. *crassulus* (Fall)	0	0	0	1	1	0	0	0	0	0	0	0	0	0
142. *laevis* (Kirby)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
143. *recticollis* (Fall)	1	1	0	0	0	0	0	0	0	0	0	0	0	0
144. *obesus cordillerensis* Larson	0	1	0	1	1	0	0	0	0	0	0	0	0	0
145. *picturatus* (Horn)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
146. *productotruncatus* (Hatch)	0	0	0	1	1	0	0	0	0	0	0	0	0	0
147. *quadrimaculatus* (Horn)	0	0	0	1	1	0	0	0	0	0	0	0	0	0
148. *sanmarkii* (Sahlberg)	0	1	1	0	0	0	0	0	0	0	0	0	0	0
149. *scitulus* (LeConte)	0	0	1	1	1	1	1	1	1	1	1	0	0	1
150. *snoqualmie* (Hatch)	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Subfamily COLYMBETINAE														
Tribe Agabini														
Agabus **Leach**														
151. *adpressus* Aubé	1	1	1	1	0	0	0	0	0	0	0	0	0	0
152. *aeruginosus* Aubé	0	0	0	0	0	0	0	1	0	0	0	0	0	0
153. *ajax* Fall	0	1	1	1	1	1	1	1	1	0	0	0	1	0
154. *ambiguus* (Say)	0	1	0	1	1	1	1	1	1	1	1	1	1	1
155. *ancillus* Fall	0	0	0	1	0	0	0	0	0	0	0	0	0	0
156. *antennatus* Leech	1	1	1	1	1	1	1	1	1	0	0	0	1	0
157. *anthracinus* Mannerheim	1	1	1	1	1	1	1	1	1	1	1	1	1	1
158. *approximatus* Fall	0	0	0	1	1	1	0	0	0	0	0	0	0	0
159. *arcticus* (Paykull)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
160. *audeni* Wallis	1	1	1	1	1	1	1	0	0	0	0	0	0	0
161. *austinii* Sharp	1	1	1	1	1	1	0	0	0	0	0	0	0	0
162. *bicolor* (Kirby)	1	1	1	1	1	1	1	1	0	0	1	0	0	0
163. *bifarius* (Kirby)	0	1	1	1	1	1	1	1	1	1	1	0	1	0
164. *bjorkmanae* Hatch	0	0	0	1	1	0	0	0	0	0	0	0	0	0
165. *canadensis* Fall	0	1	0	1	1	1	1	0	0	0	0	0	0	0
166. *clavicornis* Sharp	1	1	1	1	0	1	1	0	0	0	0	0	0	0
167. *clypealis* (Thomson)	0	1	1	0	0	0	0	0	0	0	0	0	0	0

Table 1. Continued

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
168. *colymbus* Leech	0	1	1	0	0	0	1	0	0	0	0	0	0	0
169. *confertus* LeConte	0	0	0	1	0	0	0	0	0	0	0	0	0	0
170. *confinis* (Gyllenhal)	1	1	1	1	1	1	1	1	1	0	1	0	1	1
171. *coxalis* Sharp	1	1	1	1	0	0	0	0	0	0	0	0	0	0
172. *discolor* (Harris)	1	1	1	1	1	1	1	1	1	1	1	1	1	0
173. *discors* LeConte	0	0	0	1	0	0	0	0	0	0	0	0	0	0
174. *disintegratus* (Crotch)	0	0	0	0	0	0	0	1	1	0	0	0	0	0
175. *elongatus* (Gyllenhal)	1	1	1	1	1	1	1	0	0	0	0	0	0	0
176. *erichsoni* Gemminger & Harold	1	1	1	1	1	1	1	1	1	1	1	0	1	1
177. *erythropterus* (Say)	0	0	0	0	0	0	0	0	1	1	1	0	0	1
178. *falli* (Zimmermann)	0	0	0	0	1	1	1	1	1	0	0	0	0	0
179. *flavovittatus* Larson & Wolfe	0	0	0	0	0	0	0	1	0	0	0	0	0	0
180. *fuscipennis* (Paykull)	1	1	1	1	1	1	1	1	0	0	0	0	0	0
181. *griseipennis* LeConte	0	0	0	1	1	1	0	0	0	0	0	0	0	0
182. *hypomelas* Mannerheim	1	0	0	1	1	0	0	0	0	0	0	0	0	0
183. *immaturus* Larson	0	0	0	0	0	0	0	0	0	1	0	0	0	0
184. *inexspectatus* Nilsson	1	0	0	0	0	0	0	0	0	0	0	0	0	0
185. *infuscatus* Aubé	1	1	1	1	1	0	1	1	1	0	0	0	1	1
186. *inscriptus* (Crotch)	1	1	1	1	1	1	1	1	1	0	1	0	1	1
187. *kootenai* Larson	0	0	0	1	1	0	0	0	0	0	0	0	0	0
188. *larsoni* Fery & Nilsson	0	0	0	0	0	0	0	1	1	1	1	0	0	0
189. *leptapsis* (LeConte)	0	1	0	1	1	1	1	1	1	1	1	0	1	1
190. *lutosus* LeConte	0	0	0	1	0	0	0	0	0	0	0	0	0	0
191. *mackenziensis* Larson	0	1	1	0	1	0	0	0	0	0	0	0	0	0
192. *margaretae* Larson	0	0	0	0	1	1	0	0	0	0	0	0	0	0
193. *moestus* (Curtis)	1	1	1	0	0	0	1	1	1	0	0	0	0	0
194. *obliteratus nectris* Leech	0	0	0	1	1	1	1	0	0	0	0	0	0	0
195. *oblongulus* Fall	0	0	0	1	0	0	0	0	0	0	0	0	0	0
196. *obtusatus* (Say)	0	0	0	0	0	0	0	1	1	1	1	0	0	0
197. *opacus* Aubé	1	1	1	1	1	1	1	1	1	1	0	0	0	0
198. *pallens* Poppius	1	1	1	0	0	0	1	0	0	0	0	0	0	0
199. *perplexus* Sharp	0	0	0	1	0	0	0	0	0	0	0	0	0	0
200. *phaeopterus* (Kirby)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
201. *pisobius* Leech	0	0	0	1	1	0	0	0	0	0	0	0	0	0
202. *punctulatus* Aubé	0	1	0	0	1	1	1	1	1	1	1	0	1	0
203. *semipunctatus* (Kirby)	1	1	1	1	1	1	1	1	1	1	1	0	1	1
204. *semivittatus* LeConte	0	0	0	0	0	0	0	1	1	0	0	0	0	0
205. *seriatus* (Say)	0	1	1	1	1	1	1	1	1	1	1	0	1	1
206. *smithi* Brown	0	0	0	1	1	0	0	0	0	0	0	0	0	0
207. *strigulosus* (Crotch)	1	1	1	1	1	1	1	0	0	0	0	0	0	0
208. *subfuscatus* Sharp	0	0	0	0	0	0	1	1	1	1	1	1	0	0
209. *thomsoni* (Sahlberg)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
210. *tristis* Aubé	1	1	1	1	1	1	0	0	1	0	0	0	1	1
211. *triton* Fall	0	0	0	0	1	1	1	0	0	0	0	0	0	0
212. *vancouverensis* Leech	1	0	0	1	0	0	0	0	0	0	0	0	0	0
213. *velox* Leech	1	1	1	0	0	0	1	0	0	0	0	0	0	0
214. *verisimilis* Brown	0	0	0	1	1	0	0	0	0	0	0	0	0	0
215. *wasastjernae* (Sahlberg)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
216. *zetterstedti* Thomson	1	1	1	0	0	0	1	0	0	0	0	0	0	0
***Carrhydrus* Fall**														
217. *crassipes* Fall	0	1	1	1	1	1	1	1	0	0	0	0	0	0
***Ilybius* Erichson**														

Table 1. Continued

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
218. *angustior* (Gyllenhal)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
219. *biguttulus* (Germar)	0	0	0	0	0	0	1	1	1	1	1	0	0	1
220. *churchillensis* Wallis	1	0	1	0	0	0	1	0	0	0	0	0	0	0
221. *confusus* Aubé	0	0	0	0	0	0	0	1	0	0	1	0	0	0
222. *discedens* Sharp	1	1	1	1	1	1	1	1	1	1	1	0	1	1
223. *fraterculus* (LeConte)	0	0	1	1	1	1	1	0	0	0	0	0	0	1
224. *ignarus* (LeConte)	0	0	0	0	0	0	0	1	1	0	1	0	0	0
225. *incarinatus* Zimmermann	0	0	0	0	0	0	0	1	1	0	0	0	0	0
226. *picipes* (Kirby)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
227. *pleuriticus* (LeConte)	0	1	1	1	1	1	1	1	1	1	1	1	1	1
228. *quadrimaculatus* Aubé	1	0	0	1	1	0	0	0	0	0	0	0	0	0
229. *subaeneus* (Erichson)	1	1	1	1	1	1	1	1	1	0	0	0	1	1
230. *vittiger* (Gyllenhal)	1	1	1	1	0	0	1	0	0	0	0	0	0	0
***Agabinus* Crotch**														
231. *glabrellus* (Motschulsky)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
232. *sculpturellus* Zimmermann	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Tribe Coptotomini														
***Coptotomus* Say**														
233. *longulus lenticus* Hilsenhoff	0	0	0	0	0	0	1	1	1	1	1	1	0	0
longulus longulus LeConte	0	0	0	1	1	1	1	0	0	0	0	0	0	0
234. *loticus* Hilsenhoff	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Tribe Matini														
***Matus* Aube**														
235. *bicarinatus* (Say)	0	0	0	0	0	0	0	1	0	0	0	0	0	0
236. *ovatus* Leech	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Tribe Colymbetini														
***Neoscutopterus* Balfour-Browne**														
237. *angustus* (LeConte)	0	1	0	1	1	1	1	1	1	1	1	0	1	1
238. *hornii* (Crotch)	1	1	1	1	1	1	1	1	1	1	0	0	1	0
***Rhantus* Dejean**														
239. *binotatus* (Harris)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
240. *consimilis* Motschulsky	0	0	1	1	1	1	1	1	1	0	0	0	0	0
241. *gutticollis* (Say)	0	0	0	1	0	0	0	0	0	0	0	0	0	0
242. *sericans* Sharp	1	1	1	1	1	1	1	1	1	0	0	0	0	0
243. *sinuatus* (LeConte)	0	0	1	1	1	1	1	1	1	0	1	0	0	0
244. *suturellus* (Harris)	1	1	1	1	1	1	1	1	1	0	1	0	1	1
245. *wallisi* Hatch	1	1	1	1	1	1	1	1	1	1	1	0	1	1
***Colymbetes* Dejean**														
246. *dahuricus* Aubé	1	1	1	1	1	1	1	1	1	0	0	0	0	0
247. *densus* LeConte	1	1	0	1	1	1	1	0	0	0	0	0	0	0
248. *dolabratus* (Paykull)	1	1	1	1	0	0	1	0	1	0	0	0	1	1
249. *exaratus* LeConte	0	1	1	1	1	1	1	0	0	0	0	0	0	0
250. *incognitus* Zimmerman	0	0	0	0	1	0	0	0	0	0	0	0	0	0
251. *paykulli* Erichson	0	1	1	1	1	1	1	1	1	1	1	0	0	1
252. *sculptilis* Harris	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Subfamily DYTISCINAE														
Tribe Dytiscini														
***Dytiscus* Linnaeus**														
253. *alaskanus* Balfour-Browne	1	1	1	1	1	1	1	1	1	0	0	0	1	1
254. *circumcinctus* Ahrens	1	1	1	1	1	1	1	1	1	0	0	0	0	0
255. *cordieri* Aubé	1	0	1	1	1	1	1	1	1	1	0	0	0	0

Table 1. Concluded

TAXON	AK	YK	NT	BC	AB	SK	MB	ON	PQ	NB	NS	PE	LB	NF
256. *dauricus* Gebler	1	1	1	1	1	1	1	1	1	1	1	1	1	1
257. *fasciventris* Say	0	1	1	1	1	1	1	1	1	1	1	0	1	0
258. *harrisii* Kirby	1	1	1	1	1	1	1	1	1	1	1	0	1	1
259. *hatchi* Wallis	0	0	0	1	0	0	0	0	0	0	0	0	0	0
260. *hybridus* Aubé	0	0	0	0	1	1	1	1	1	1	0	0	0	0
261. *marginicollis* LeConte	0	0	1	1	1	1	1	0	0	0	0	0	0	0
262. *verticalis* Say	0	0	0	0	0	0	1	1	1	1	1	1	0	0
Tribe Hydaticini														
***Hydaticus* Leach**														
263. *aruspex* Clark	1	1	1	1	1	1	1	1	1	1	1	1	1	1
264. *piceus* LeConte	0	0	0	0	1	1	1	1	1	0	1	0	0	0
Tribe Aciliini														
***Acilius* Leach**														
265. *abbreviatus* Mannerheim	1	0	0	1	1	0	0	0	0	0	0	0	0	0
266. *athabascae* Larson	0	0	0	1	1	1	1	1	1	0	1	0	0	0
267. *mediatus* (Say)	0	0	0	0	0	0	0	1	1	1	1	0	0	0
268. *semisulcatus* Aubé	1	1	1	1	1	1	1	1	1	1	1	1	1	1
269. *sylvanus* Hilsenhoff	0	0	0	0	0	0	1	1	1	0	0	0	0	0
***Graphoderus* Dejean**														
270. *fascicollis* (Harris)	0	0	0	0	0	0	0	1	1	0	1	0	0	0
271. *liberus* (Say)	0	0	1	1	1	1	1	1	1	1	1	0	0	1
272. *manitobensis* Wallis	0	0	0	0	0	0	1	0	0	0	0	0	0	0
273. *occidentalis* Horn	0	1	1	1	1	1	1	1	1	0	0	0	0	0
274. *perplexus* Sharp	1	1	1	1	1	1	1	1	1	1	1	1	1	1
***Thermonectus* Dejean**														
275. *basilaris* (Harris)	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tribe Cybistrini														
***Cybister* Curtis**														
276. *fimbriolatus* (Say)	0	0	0	0	0	0	1	1	0	0	1	0	0	0
TOTAL SPECIES	**100**	**116**	**122**	**175**	**156**	**126**	**148**	**159**	**148**	**83**	**86**	**32**	**78**	**80**

The distribution of species by province is given in Table 1. These distribution data were tabulated before the creation of the Territory of Nunavit so in this work the Northwest Territories is treated in the older, more inclusive sense. In general, the provinces with the richest faunas are also the largest in area. Larson (1997*b)* found that the best single predictor of dytiscid species richness in a geographical region was the surface area of the region. Aside from regions of extreme conditions, such as the arctic or possibly isolated oceanic islands, this relationship holds in a general way throughout the world. In many groups there is an increase in diversity towards lower latitudes but this is not apparent in Dytiscidae where Canada's fauna is about as rich as that of any other region of similar size. Similarly, the larger provinces have more species but this is complicated by very unequal collecting effort in the various provinces. For example, Prince Edward Island's small list is due to the fact that most of the Island's records are based on a two day collecting trip made by L. LeSage. The other maritime provinces are only little better explored whereas at the other extreme, since 1950, almost no accessible water body in Alberta has been missed by John Carr's collecting net.

Why there is a relationship between area and species richness is not obvious. There must be an interplay between history and habitat diversity. Canada has an unsurpassed variety and abundance of water beetle habitat largely as a result of its recent glacial history. But on the other hand, the recency of total or almost total annihilation of the fauna during the Wisconsinan glacial maximum means that there has been little chance for an endemic fauna to develop. In post-glacial times, most of the fauna must have reinvaded Canada from southern refugia following latitudinal shifts in climate and vegetation zones. A number of boreal species are now known only from areas that were glaciated in Wisconsinan times and presumably their ranges changed as the zone of boreal conditions shifted. Another important source area of the fauna is the Behringian region of the Yukon Territory and Alaska (Danks and Downes 1997; Larson 1997*b*). This area acted as both a refugium as well as a corridor for movement of species from the Palaearctic. The importance of this exchange is indicated by the fact that about 16% of the fauna is Holarctic.

Table 2. Checklist of Dytiscidae of Canada, by ecozone (Ecological Stratification Working Group 1996). Ecozones: PAC - Pacific Maritime; MCO - Montane Cordillera; BCO - Boreal Cordillera; TCO - Taiga Cordillera; PLA - Prairies; BPL - Boreal Plain; TPL - Taiga Plain; BOR - Boreal Shield; TAG - Taiga Shield; HUD - Hudson Plains; MP - Mixedwood Plains; MAR - Atlantic Maritime; ARC - pooled Arctic zones.

TAXON	PAC	MCO	BCO	TCO	PLA	BPL	TPL	BOR	TAG	HUD	MP	MAR	ARC	TOTAL
Subfamily COPELATINAE														
***Copelatus* Erichson**														
1. *chevrolati* Aubé	0	0	0	0	0	0	0	0	0	0	1	0	0	1
2. *glyphicus* (Say)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
Subfamily AGABETINAE														
***Agabetes* Crotch**														
3. *acuductus* (Harris)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Subfamily LACCOPHILINAE														
***Laccophilus* Leach**														
4. *biguttatus* Kirby	1	1	1	1	1	1	1	1	1	1	1	1	0	12
5. *maculosus* Say	0	0	0	0	0	1	0	1	0	0	1	1	0	4
6. *proximus* Say	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Subfamily HYDROPORINAE														
Tribe Laccornini														
***Laccornis* des Gozis**														
7. *conoideus* (LeConte)	0	1	1	1	1	1	1	1	1	0	1	1	0	10
8. *deltoides* (Fall)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
9. *latens* (Fall)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
10. *oblongus* (Stephens)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
11. *pacificus* (Leech)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Tribe Methlini														
***Celina* Aubé**														
12. *hubbelli* Young	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Tribe Hydrovatini														
***Hydrovatus* Motschoulsky**														
13. *pustulatus* (Melsheimer)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Tribe Hyphydrini														
***Desmopachria* Babington**														
14. *convexa* (Aubé)	1	1	0	0	0	1	1	1	0	0	1	1	0	7
Tribe Bidessini														
***Bidessonotus* Régimbart**														
15. *inconspicuus* (LeConte)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
16. *pulicarius* (Aubé)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
***Liodessus* Guignot**														
17. *affinis* (Say)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
18. *cantralli* (Young)	0	0	0	0	0	1	0	1	0	0	0	0	0	2
19. *flavicollis* (LeConte)	0	0	0	0	0	1	0	0	0	0	1	0	0	2
20. *fuscatus* (Crotch)	0	0	0	0	0	1	0	1	1	0	1	1	0	5
21. *noviaffinis* Miller	0	0	0	0	0	0	0	0	0	0	0	1	0	1
22. *obscurellus* (LeConte)	1	1	1	0	1	1	1	1	0	0	0	0	0	7
***Neoclypeodytes* Young**														
23. *cinctellus* (LeConte)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
24. *ornatellus* (Fall)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
***Uvarus* Guignot**														
25. *falli* (Young)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
26. *granarius* (Aubé)	0	0	0	0	0	1	0	1	0	0	1	1	0	4
27. *lacustris* (Say)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
28. *subtilis* (LeConte)	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Tribe Hydroporini														
***Hygrotus* Stephens**														
29. *acaroides* (LeConte)	0	0	0	0	1	0	0	0	0	0	0	0	0	1
30. *bruesi* (Fall)	0	0	0	0	1	0	0	0	0	0	0	0	0	1
31. *compar* (Fall)	0	1	0	0	1	1	0	1	0	0	0	1	0	5
32. *dissimilis* G.& H.	1	1	0	0	0	1	0	0	0	0	1	0	0	4
33. *falli* (Wallis)	0	0	0	0	0	0	0	1	0	0	0	0	0	1
34. *farctus* (LeConte)	0	0	0	0	0	1	0	1	0	0	1	1	0	4

Table 2. Continued

TAXON	PAC	MCO	BCO	TCO	PLA	BPL	TPL	BOR	TAG	HUD	MP	MAR	ARC	TOTAL
35. *impressopunctatus* (Schaller)	1	1	1	1	1	1	1	1	0	1	1	1	0	11
36. *infuscatus* (Sharp)	0	1	1	0	1	1	1	0	0	0	0	0	0	5
37. *intermedius* (Fall)	1	0	0	0	0	0	0	0	0	0	0	0	0	1
38. *laccophilinus* (LeConte)	0	0	0	0	0	1	1	1	0	0	1	1	0	5
39. *lutescens* (LeConte)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
40. *marklini* (Gyllenhal)	0	0	1	0	1	1	1	1	1	0	0	0	0	6
41. *masculinus* (Crotch)	0	1	0	0	1	0	0	0	0	0	0	0	0	2
42. *nigrescens* (Fall)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
43. *novemlineatus hudsonicus* (Fall)	0	0	1	1	0	0	1	1	1	1	0	0	1	7
44. *nubilus* (LeConte)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
45. *obscureplagiatus* (Fall)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
46. *patruelis* (LeConte)	0	1	1	0	1	1	1	1	1	0	0	0	0	7
47. *picatus* (Kirby)	0	1	1	1	1	1	1	1	1	1	1	1	0	11
48. *punctilineatus* (Fall)	0	1	1	0	1	1	0	0	0	0	0	0	0	4
49. *salinarius* (Wallis)	0	1	0	0	1	1	0	0	0	0	0	0	0	3
50. *sayi* Balfour-Browne	1	1	1	0	1	1	1	1	0	0	1	1	0	9
51. *sellatus* (LeConte)	0	0	1	0	1	1	0	0	0	0	0	0	0	3
52. *semivittatus* (Fall)	0	1	0	0	1	0	0	0	0	0	0	0	0	2
53. *suturalis* (LeConte)	0	1	1	0	1	1	1	1	1	1	1	0	0	9
54. *sylvanus* (Fall)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
55. *tumidiventris* (Fall)	0	1	0	0	1	1	1	0	0	0	0	0	0	4
56. *turbidus* (LeConte)	0	1	1	0	1	1	1	1	0	0	1	1	0	8
57. *unguicularis* (Crotch)	0	1	1	0	1	1	1	1	1	1	0	0	0	8
Sanfilippodytes **Franciscolo**														
58. *bertae* Roughley & Larson	1	1	0	0	0	0	0	0	0	0	0	0	0	2
59. *brumalis* (Brown)	1	1	0	0	1	1	0	1	0	0	0	0	0	5
60. *compertus* (Brown)	1	1	1	0	1	1	0	0	0	0	0	0	0	5
61. *edwardsi* (Wallis)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
62. *pacificus* (Fall)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
63. *planiusculus* (Fall)	0	0	0	0	0	0	0	1	1	0	0	0	0	2
64. *pseudovilis* (Young)	1	1	1	0	1	1	0	1	1	0	1	0	0	8
65. *terminalis* (Sharp)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Heterosternuta **Strand**														
66. *allegheniamus* (Matta & Wolfe)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
67. *cocheconis* (Fall)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
68. *pulcher* (Fall)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
69. *wickhami* (Zaitzev)	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Neoporus **Guignot**														
70. *blanchardi* (Sherman)	0	0	0	0	0	0	0	0	0	0	0	1	0	1
71. *carolinus* (Fall)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
72. *clypealis* (Sharp)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
73. *dilatatus* (Fall)	0	0	0	0	0	0	0	0	0	0	0	1	0	1
74. *dimidiatus* (Gemminger & Harold)	0	1	0	0	1	1	0	1	0	0	1	1	0	6
75. *mellitus* (LeConte)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
76. *spurius* (LeConte)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
77. *sulcipennis* (Fall)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
78. *superioris* (Balfour-Browne)	0	1	1	0	1	1	1	1	1	0	0	0	0	7
79. *tennetum* (Wolfe)	1	1	0	0	0	0	0	0	0	0	1	0	0	3
80. *undulatus* (Say)	1	1	0	0	1	1	1	1	0	0	1	1	0	8
81. *vittatus* (LeConte)	0	0	0	0	1	0	0	0	0	0	0	0	0	1
82. *vitiosus* (LeConte)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hydroporus **Clairville**														
83. *appalachius* Sherman	0	0	1	1	1	1	1	1	1	1	0	1	0	9
84. *aurora* Larson & Roughley	0	0	0	0	0	0	1	0	1	0	0	0	0	2
85. *badiellus* Fall	0	1	1	1	0	1	1	1	1	0	1	1	0	9
86. *boraeorum* Larson & Roughley	0	0	1	1	0	0	1	0	1	0	0	0	0	4
87. *brevicornis* Fall	0	0	0	0	0	0	0	1	1	0	1	1	0	4
88. *carri* Larson	0	1	0	0	0	0	0	0	0	0	0	0	0	1
89. *columbianus* Fall	1	1	1	0	0	1	1	1	0	0	1	1	0	8
90. *dentellus* Fall	0	1	1	1	0	1	1	1	1	1	1	1	0	10
91. *despectus* Sharp	0	1	1	1	0	1	1	1	1	0	1	0	0	8
92. *dichrous* Melsheimer	0	0	0	0	0	0	0	1	0	0	1	0	0	2
93. *fortis* LeConte	1	0	0	0	0	0	0	0	0	0	0	0	0	1
94. *funestus* Fall	1	0	0	0	0	0	0	0	0	0	0	0	0	1

Table 2. Continued

TAXON	PAC	MCO	BCO	TCO	PLA	BPL	TPL	BOR	TAG	HUD	MP	MAR	ARC	TOTAL
95. *fuscipennis* Schaum	0	1	1	1	1	1	1	1	1	1	1	1	0	11
96. *geniculatus* Thomson	0	1	1	0	0	1	0	0	0	0	0	0	0	3
97. *gossei* Larson & Roughley	0	0	0	0	0	0	0	1	0	0	0	1	0	2
98. *hirtellus* LeConte	1	0	0	0	0	0	0	0	0	0	0	0	0	1
99. *lapponum* Gyllenhal	0	0	1	1	0	0	1	1	1	1	0	0	1	7
100. *larsoni* Nilsson	0	1	1	1	1	1	1	1	1	0	0	0	0	8
101. *longiusculus* Gemminger & Harold	1	1	0	0	0	0	0	0	0	0	0	0	0	2
102. *mannerheimi* Balfour-Browne	1	1	1	0	0	1	0	0	0	0	0	0	0	4
103. *melsheimeri* Fall	0	0	0	0	0	0	0	1	0	0	1	0	0	2
104. *morio* Aube	0	0	1	1	0	1	1	1	1	1	1	1	1	10
105. *nigellus* Mannerheim	0	0	1	1	0	1	1	1	1	1	0	1	0	8
106. *niger* Say	0	0	0	0	0	0	0	1	0	0	1	1	0	3
107. *notabilis* LeConte	1	1	1	1	1	1	1	1	1	1	1	1	1	13
108. *obscurus* Sturm	0	1	1	0	0	1	1	1	1	0	0	1	0	7
109. *occidentalis* Sharp	1	1	1	1	0	1	1	0	0	0	0	0	0	6
110. *pervicinus* Fall	0	1	0	0	1	1	0	0	0	0	0	0	0	3
111. *polaris* Fall	0	0	0	1	0	0	1	0	1	0	0	0	1	4
112. *puberulus* LeConte	0	1	1	1	0	1	1	1	1	1	0	1	0	9
113. *rectus* Fall	0	1	1	1	0	1	1	1	1	0	1	1	0	9
114. *rufinasus* Mannerheim	0	1	1	1	0	1	1	1	1	1	0	1	0	9
115. *sibiricus* Sahlberg	0	0	1	1	0	0	0	0	0	0	0	0	1	3
116. *signatus* Mannerheim	1	1	1	1	0	1	1	1	1	1	1	1	0	11
117. *similaris* Fall	1	0	0	0	0	0	0	0	0	0	0	0	0	1
118. *sinuatipes* Fall	1	0	0	0	0	0	0	0	0	0	0	0	0	1
119. *striola* (Gyllenhal)	1	1	1	1	1	1	1	1	1	1	1	1	1	13
120. *tademus* Leech	0	1	0	0	0	0	0	0	0	0	0	0	0	1
121. *tartaricus* LeConte	1	1	0	0	0	1	0	1	0	0	0	0	0	4
122. *tenebrosus* LeConte	0	1	1	1	1	1	1	1	1	1	1	1	0	11
123. *transpunctatus* Chandler	1	1	0	0	0	0	0	0	0	0	0	0	0	2
124. *tristis* (Paykull)	1	1	1	1	0	1	1	1	1	1	1	1	0	11
***Hydrocolus* Roughley & Larson**														
125. *persimilis* (Crotch)	0	0	0	0	0	0	0	1	1	0	0	1	0	3
126. *paugus* (Fall)	0	1	1	1	0	1	1	1	1	0	1	1	0	9
127. *rubyae* (Larson)	0	0	1	0	0	1	1	1	1	0	0	1	0	6
128. *stagnalis* (Gemminger & Harold)	0	0	0	0	0	1	1	1	0	0	0	1	0	4
***Stictotarsus* Zimmermann**														
129. *aequinoctialis* (Clark)	0	0	0	0	1	0	0	0	0	0	0	0	0	1
130. *deceptus* (Fall)	1	0	0	0	0	0	0	0	0	0	0	0	0	1
131. *griseostriatus* (DeGeer)	1	1	1	1	1	1	1	1	1	1	1	1	1	13
132. *minipi* (Larson)	0	0	0	0	0	0	0	0	1	0	0	0	0	1
133. *spenceri* (Leech)	0	1	1	0	1	0	0	0	0	0	0	0	0	3
134. *striatellus* (LeConte)	1	1	1	0	1	1	0	1	1	0	0	0	0	7
***Nebrioporus* Regimbart**														
135. *depressus* (Fabricius)	0	0	1	0	0	1	1	0	1	0	0	0	0	4
136. *macronychus* (Shirt)	1	1	0	0	1	1	0	1	0	0	0	0	0	5
137. *rotundatus* (LeConte)	0	0	0	0	0	0	0	1	1	0	1	1	0	4
***Oreodytes* Seidlitz**														
138. *alaskanus* (Fall)	1	1	1	0	0	0	0	0	0	0	0	0	0	3
139. *angustior* (Hatch)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
140. *congruus* (LeConte)	1	1	0	0	0	1	0	0	0	0	0	0	0	3
141. *crassulus* (Fall)	0	1	0	0	1	1	0	0	0	0	0	0	0	3
142. *laevis* (Kirby)	0	1	1	1	0	1	1	1	1	1	0	1	0	9
143. *recticollis* (Fall)	0	0	1	1	0	0	0	0	0	0	0	0	0	2
144. *obesus cordillerensis* Larson	1	1	1	0	0	1	0	0	0	0	0	0	0	4
145. *picturatus* (Horn)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
146. *productotruncatus* (Hatch)	0	1	0	0	0	1	0	0	0	0	0	0	0	2
147. *quadrimaculatus* (Horn)	0	1	0	0	0	1	0	0	0	0	0	0	0	2
148. *sanmarkii* (Sahlberg)	0	0	0	1	0	0	0	0	0	0	0	0	1	2
149. *scitulus* (LeConte)	1	1	0	0	1	1	1	1	0	0	1	1	0	8
150. *snoqualmie* (Hatch)	1	1	0	0	0	1	0	0	0	0	0	0	0	3
Subfamily COLYMBETINAE														
Tribe Agabini														
***Agabus* Leach**														
151. *adpressus* Aubé	0	0	1	1	0	0	1	0	0	0	0	0	1	4
152. *aeruginosus* Aubé	0	0	0	0	0	0	0	0	0	0	1	0	0	1

Table 2. Continued

TAXON	PAC	MCO	BCO	TCO	PLA	BPL	TPL	BOR	TAG	HUD	MP	MAR	ARC	TOTAL
153. *ajax* Fall	0	1	1	1	1	1	1	1	1	1	0	0	0	9
154. *ambiguus* (Say)	1	1	1	0	1	1	1	1	0	0	1	1	0	9
155. *ancillus* Fall	1	0	0	0	0	0	0	0	0	0	0	0	0	1
156. *antennatus* Leech	0	1	1	1	1	1	1	1	1	1	0	0	0	9
157. *anthracinus* Mannerheim	1	1	1	1	1	1	1	1	1	1	1	1	0	12
158. *approximatus* Fall	0	1	0	0	1	0	0	0	0	0	0	0	0	2
159. *arcticus* (Paykull)	0	0	1	1	0	1	1	1	1	1	0	0	1	8
160. *audeni* Wallis	0	1	1	1	1	1	1	1	1	0	0	0	0	8
161. *austinii* Sharp	1	1	1	0	1	1	1	0	0	0	0	0	0	6
162. *bicolor* (Kirby)	0	1	1	1	0	1	1	1	1	1	1	1	0	10
163. *bifarius* (Kirby)	0	1	1	1	1	1	1	1	1	1	1	1	0	11
164. *bjorkmanae* Hatch	1	1	0	0	1	1	0	0	0	0	0	0	0	4
165. *canadensis* Fall	0	1	1	0	1	1	0	0	0	0	0	0	0	4
166. *clavicornis* Sharp	0	0	1	1	0	0	1	1	1	0	0	0	1	6
167. *clypealis* (Thomson)	0	0	0	1	0	0	1	0	0	0	0	0	0	2
168. *colymbus* Leech	0	0	0	1	0	0	0	0	1	0	1	0	1	4
169. *confertus* LeConte	1	0	0	0	0	0	0	0	0	0	0	0	0	1
170. *confinis* (Gyllenhal)	1	1	1	1	0	1	1	1	1	1	1	1	0	11
171. *coxalis* Sharp	0	0	1	0	0	0	1	0	0	0	0	0	0	2
172. *discolor* (Harris)	0	1	1	1	1	1	1	1	1	1	1	1	0	11
173. *discors* LeConte	1	0	0	0	0	0	0	0	0	0	0	0	0	1
174. *disintegratus* (Crotch)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
175. *elongatus* (Gyllenhal)	0	0	1	1	0	1	1	1	1	0	0	0	1	7
176. *erichsoni* Gemminger & Harold	1	1	1	1	1	1	1	1	1	1	1	1	0	12
177. *erythropterus* (Say)	0	0	0	0	0	0	0	1	0	0	0	1	0	2
178. *falli* (Zimmermann)	0	0	0	0	1	1	0	0	0	0	1	0	0	3
179. *flavovittatus* Larson & Wolfe	0	0	0	0	0	0	0	0	0	0	1	0	0	1
180. *fuscipennis* (Paykull)	0	1	1	1	1	1	1	0	1	0	1	0	0	8
181. *griseipennis* LeConte	0	1	0	0	1	0	0	0	0	0	0	0	0	2
182. *hypomelas* Mannerheim	1	1	0	0	0	0	0	0	0	0	0	0	0	2
183. *immaturus* Larson	0	0	0	0	0	0	0	0	0	0	0	1	0	1
184. *inexspectatus* Nilsson	0	0	0	0	0	0	0	0	0	0	0	0	0	0
185. *infuscatus* Aubé	0	0	1	1	0	1	1	1	1	1	0	0	1	8
186. *inscriptus* (Crotch)	1	1	1	1	0	1	1	1	1	1	1	1	0	11
187. *kootenai* Larson	1	1	0	0	0	1	0	0	0	0	0	0	0	3
188. *larsoni* Fery & Nilsson	0	0	0	0	0	0	0	1	0	0	1	1	0	3
189. *leptapsis* (LeConte)	0	0	1	0	0	1	0	1	1	0	0	1	0	5
190. *lutosus* LeConte	1	0	0	0	0	0	0	0	0	0	0	0	0	1
191. *mackenziensis* Larson	0	0	1	0	0	1	1	0	1	0	0	0	0	4
192. *margaretae* Larson	0	0	0	0	1	0	0	0	0	0	0	0	0	1
193. *moestus* (Curtis)	0	0	1	1	0	0	0	0	1	1	0	0	1	5
194. *obliteratus nectris* Leech	1	1	0	0	1	0	0	0	0	0	0	0	0	3
195. *oblongulus* Fall	1	0	0	0	0	0	0	0	0	0	0	0	0	1
196. *obtusatus* (Say)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
197. *opacus* Aubé	0	0	1	1	1	1	1	0	0	0	1	1	0	7
198. *pallens* Poppius	0	0	0	0	0	0	0	0	1	0	0	0	1	2
199. *perplexus* Sharp	1	1	0	0	0	0	0	0	0	0	0	0	0	2
200. *phaeopterus* (Kirby)	0	1	1	1	1	1	1	1	1	1	1	1	0	11
201. *pisobius* Leech	0	1	0	0	0	0	0	0	0	0	0	0	0	1
202. *punctulatus* Aubé	0	1	1	0	1	1	0	0	1	0	1	1	0	7
203. *semipunctatus* (Kirby)	0	1	1	1	0	1	1	1	1	1	1	1	0	10
204. *semivittatus* LeConte	0	0	0	0	0	0	0	0	0	0	1	0	0	1
205. *seriatus* (Say)	1	1	1	0	1	1	1	1	1	1	1	1	0	11
206. *smithi* Brown	1	1	0	0	0	0	0	0	0	0	0	0	0	2
207. *strigulosus* (Crotch)	1	1	1	1	1	1	1	1	0	0	0	0	0	8
208. *subfuscatus* Sharp	0	0	0	0	0	0	0	1	0	0	1	1	0	3
209. *thomsoni* (Sahlberg)	0	1	1	1	0	1	1	1	1	1	0	1	1	10
210. *tristis* Aubé	1	1	1	1	1	1	1	1	1	0	0	0	1	10
211. *triton* Fall	0	0	0	0	1	1	0	0	0	0	0	0	0	2
212. *vancouverensis* Leech	1	0	0	0	0	0	0	0	0	0	0	0	0	1
213. *velox* Leech	0	0	1	1	0	0	1	0	1	0	0	0	0	4
214. *verisimilis* Brown	0	1	0	0	0	0	0	0	0	0	0	0	0	1
215. *wasastjernae* (Sahlberg)	0	0	1	1	0	1	1	1	1	0	1	0	0	7
216. *zetterstedti* Thomson	0	0	0	1	0	0	1	0	1	0	0	0	1	4

Table 2. Continued

TAXON	PAC	MCO	HCO	TCO	PLA	BPL	TPL	BOR	TAG	HUD	MP	MAR	ARC	TOTAL
***Carrhydrus* Fall**														
217. *crassipes* Fall	0	0	1	0	1	1	1	0	1	1	0	0	0	6
***Ilybius* Erichson**														
218. *angustior* (Gyllenhal)	0	1	1	1	1	1	1	1	1	1	1	1	1	12
219. *biguttulus* (Germar)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
220. *churchillensis* Wallis	0	0	0	0	0	0	0	0	1	0	0	0	1	2
221. *confusus* Aubé	0	0	0	0	0	0	0	1	0	0	1	1	0	3
222. *discedens* Sharp	0	1	1	1	0	1	1	1	1	1	1	1	0	10
223. *fraterculus* (LeConte)	0	1	0	0	1	1	1	1	0	0	0	0	0	5
224. *ignarus* (LeConte)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
225. *incarinatus* Zimmermann	0	0	0	0	0	0	0	1	0	0	1	1	0	3
226. *picipes* (Kirby)	0	1	1	1	1	1	1	1	1	1	1	0	0	10
227. *pleuriticus* (LeConte)	0	1	1	0	1	1	1	1	1	0	1	1	0	9
228. *quadrimaculatus* Aubé	1	1	1	0	0	1	0	0	0	0	0	0	0	4
229. *subaeneus* (Erichson)	0	1	1	1	1	1	1	1	1	1	0	1	0	10
230. *vittiger* (Gyllenhal)	0	0	0	1	0	0	1	0	1	0	0	0	1	4
***Agabinus* Crotch**														
231. *glabrellus* (Motschulsky)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
232. *sculpturellus* Zimmermann	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Tribe Coptotomini														
***Coptotomus* Say**														
233. *longulus* LeConte	1	1	0	0	1	1	0	1	0	0	1	1	0	7
234. *loticus* Hilsenhoff	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Tribe Matini														
***Matus* Aubé**														
235. *bicarinatus* (Say)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
236. *ovatus* Leech	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Tribe Colymbetini														
***Neoscutopterus* Balfour-Browne**														
237. *angustus* (LeConte)	0	1	1	0	0	1	0	1	1	1	1	1	0	8
238. *hornii* (Crotch)	0	1	1	1	0	1	1	1	1	1	1	1	0	10
***Rhantus* Dejean**														
239. *binotatus* (Harris)	1	1	1	1	1	1	1	1	1	1	1	1	0	12
240. *consimilis* Motschulsky	1	1	0	0	1	1	0	1	0	0	1	0	0	6
241. *gutticollis* (Say)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
242. *sericans* Sharp	0	1	1	0	1	1	1	1	0	0	1	0	0	7
243. *sinuatus* (LeConte)	0	1	0	0	0	1	1	1	0	0	1	1	0	6
244. *suturellus* (Harris)	1	1	1	1	0	1	1	1	1	1	0	1	0	10
245. *wallisi* Hatch	0	1	1	1	1	1	1	1	1	0	1	1	0	10
***Colymbetes* Dejean**														
246. *dahuricus* Aubé	1	1	1	1	0	1	1	1	1	1	0	0	0	9
247. *densus* LeConte	1	1	1	0	0	1	1	1	0	0	0	0	0	6
248. *dolabratus* (Paykull)	0	0	1	1	0	0	1	0	1	1	0	0	1	6
249. *exaratus* LeConte	0	1	1	0	1	1	1	0	0	0	0	0	0	5
250. *incognitus* Zimmerman	0	0	0	0	1	0	0	0	0	0	0	0	0	1
251. *paykulli* Erichson	1	1	1	0	0	1	1	1	0	1	1	1	0	9
252. *sculptilis* Harris	1	1	1	0	0	1	1	1	0	0	1	1	0	8
Subfamily DYTISCINAE														
Tribe Dytiscini														
***Dytiscus* Linne**														
253. *alaskanus* Balfour-Browne	0	1	1	1	1	1	1	1	1	1	1	1	1	12
254. *circumcinctus* Ahrens	1	1	1	1	1	1	1	1	1	1	1	0	0	11
255. *cordieri* Aubé	1	1	1	0	1	1	0	1	0	0	1	1	0	8
256. *dauricus* Gebler	1	1	1	1	1	1	1	1	1	1	1	1	0	12
257. *fasciventris* Say	1	0	1	0	1	1	0	1	0	1	1	1	0	8
258. *harrisii* Kirby	1	1	1	1	0	1	1	1	1	1	1	1	0	11
259. *hatchi* Wallis	1	1	0	0	0	0	1	0	0	0	0	0	0	3
260. *hybridus* Aubé	0	0	0	0	1	0	0	1	0	0	1	0	0	3
261. *marginicollis* LeConte	1	1	0	0	1	0	0	0	0	0	0	0	0	3
262. *verticalis* Say	0	0	0	0	0	0	0	1	0	0	1	1	0	3

Table 2 Concluded

TAXON	PAC	MCO	BCO	TCO	PLA	BPL	TPL	BOR	TAG	HUD	MP	MAR	ARC	TOTAL
Tribe Hydaticini														
***Hydaticus* Leach**														
263. *aruspex* Clark	1	1	1	0	1	1	1	1	0	0	1	1	0	9
264. *piceus* LeConte	0	0	0	0	0	1	0	1	0	0	1	1	0	4
Tribe Aciliini														
***Acilius* Leach**														
265. *abbreviatus* Mannerheim	1	1	0	0	0	0	0	0	0	0	0	0	0	2
266. *athabascae* Larson	0	0	1	0	0	1	0	1	1	0	0	0	0	4
267. *mediatus* (Say)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
268. *semisulcatus* Aubé	1	1	1	1	1	1	1	1	1	1	1	1	0	12
269. *sylvanus* Hilsenhoff	0	0	0	0	1	0	0	1	0	0	1	0	0	3
***Graphoderus* Dejean**														
270. *fascicollis* (Harris)	0	0	0	0	0	0	0	1	0	0	1	1	0	3
271. *liberus* (Say)	1	1	0	0	0	1	1	1	1	0	1	1	0	8
272. *manitobensis* Wallis	0	0	0	0	1	0	0	0	0	0	0	0	0	1
273. *occidentalis* Horn	1	1	1	0	1	1	1	1	1	0	0	0	0	8
274. *perplexus* Sharp	1	1	1	1	1	1	1	1	1	1	1	1	0	12
***Thermonectus* Dejean**														
275. *basillaris* (Harris)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Tribe Cybistrini														
***Cybister* Curtis**														
276. *fimbriolatus* (Say)	0	0	0	0	1	0	0	0	0	0	1	1	0	3
TOTAL SPECIES	88	144	115	76	93	137	109	139	96	56	127	109	26	1315

The varied topography, soil types and climates across Canada produces a variety of aquatic habitats suitable for water beetles (Williams 1979). Canada's curse, winter and snow, actually contribute to the suitability of country for water beetles. Snow locks up water that is released when it melts producing adequate amounts of water to fill temporary or vernal pools in the spring long enough for water beetles to complete development. Without snow and without the glaciated topography that created immature landscapes and occluded drainage systems, shallow, lentic habitat would be much less abundant. Most of Canada's water beetles are in these shallow, lentic habitats. If these sorts of habitats support much of the fauna, why then are areas south of the glaciated region and snow belt similarly species rich? In southern latitudes, a higher proportion of the fauna is lotic and numbers of lotic species decrease with latitude (Roughley and Larson 1991). Although a few lotic species occur into the low arctic, in the north these species mainly occur along lake shores rather than in streams as they do in southern parts of their ranges. Why there are relatively few lotic species in the north is unknown but perhaps the energetic demands of coping with a flowing water environment are too great for insects functioning at low temperatures.

A biologically more meaningful way of analysing the fauna is by ecological region. Recently a system of classifying Canada's ecological regions has been developed (Ecological Stratification Working Group 1996). At the coarsest scale, 13 ecozones are recognized (in this discussion the Arctic Cordillera, Northern Arctic and Southern Arctic Ecozones are pooled). The dytiscid fauna of each ecozone is listed in Table 2. Because ecozone boundaries are not sharply drawn on a map like political boundaries, there is a certain arbitrariness in assigning species to ecozones. However, some general patterns appear. The smallest faunas are in the Arctic and Hudson Plains ecozones. Not all ecozones have been collected with the same intensity and the arctic region especially has been very sparsely sampled. Nevertheless because these few collections repeatedly contain the same limited suite of species there is no indication that the fauna is much richer than indicated here. On the other hand, the Hudson Plains has very few collections but these are quite species rich and it is certain that this ecozone, with further exploration, will prove to have a much richer fauna. Among the remaining ecozones there is still a trend towards a relationship between area and faunal-richness. The largest

Table 3. Dytiscidae species unique to Canadian ecozones.

ECOZONE	Species known in Canada only from Ecozone (species numbering as in Tables 1 and 2)	Status and general habitat	Total species (Unique species); Unique as % of ecozone fauna
Pacific Maritime	28. *Uvarus subtilis* 37. *Hygrotus intermedius* 93. *Hydroporus fortis* 98. *H. hirtellus* 115. *H. similaris* 116. *H. sinuatipes* 128. *Stictotarsus deceptus* 153. *Agabus ancillus* 167. *A. confertus* 171. *A. discors* 188. *A. lutosus* 193. *A. oblongulus* 210. *A. vancouverensis*	adventitious? common, lentic common, lentic ?, lentic ?, lentic ?, lentic adventitious local, lotic common but local, lotic common but local, lentic common local common, alpine, lentic	88 (13) 15 %
Montane Cordillera	23. Neoclypeodytes cinctellus 39. *Hygrotus lutescens* 42. *H. nigrescens* 88. *Hydroporus carri* 118. *H. tademus* 137. *Oreodytes angustior* 143. *O. picturatus* 199. *Agabus pisobius* 212. *Agabus verisimilis* 229. *Agabinus glabrellus*	adventitious common common uncommon, in springs common common, lotic uncommon, lotic common, lentic common, lentic uncommon, lotic	144 (10) 7 %
Boreal Cordillera	0		115 (0)
Taiga Cordillera	0		76 (0)
Prairies	29. *Hygrotus acaroides* 30. *H. bruesi* 60. *Sanfilippodytes bertae* 81. *Neoporus vittatus* 127. *Stictotarsus aequinoctialis* 190. *Agabus margaretae* 248. *Colymbetes incognitus* 270. *Graphoderus manitobensis*	uncommon, lentic local, saline ponds uncommon, lotic local, lotic adventitious uncommon, lentic common, lentic rare, lentic	93 (8) 9 %
Boreal Plains	0		137 (0)
Taiga Plains	0		109 (0)
Boreal Shield	33. *Hygrotus falli*	common, lentic	139 (1) 1 %
Taiga Shield	130. *Stictotarsus minipi*	1 specimen known	96 (1) 1 %

Table 3. Concluded

Hudson Plains	0		56 (0)
Mixedwood Plains	1. *Copelatus chevrolati*	uncommon, lentic	127 (17)
	3. *Agabetes acuductus*	common, lentic	14 %
	6. *Laccophilus proximus*	adventitious?	
	8. *Laccornis deltoides*	1 record, lentic	
	12. *Celina hubbelli*	common, lentic	
	13. *Hydrovatus pustulatus*	common, lentic	
	16. *Bidessonotus pulicarius*	light trap, adventitious?	
	27. *Uvarus lacustris*	adventitious?	
	54. *Hygrotus sylvanus*	uncommon, lentic	
	67. *Heterosternuta cocheconis*	local, lotic	
	82. *Neoporus vitiosus*	common, lotic	
	150. *Agabus aeruginosus*	1 locality, lentic	
	172. *A. disintegratus*	uncommon, lentic	
	177. *A. flavovittatus*	uncommon, lotic	
	202. *A. semivittatus*	uncommon, lotic	
	233. *Matus bicarinatus*	common, lentic	
	273. *Thermonectus basilaris*	uncommon.	
Atlantic Maritime	21. *Liodessus noviaffinis*	?, lentic	109 (4)
	70. *Neoporus blanchardi*	local, lotic	4 %
	73. *Neoporus dilatatus*	1 record, lotic	
	181. *Agabus immaturus*	local, lentic	
pooled Arctic zones	10. *Laccornis oblongus*	1 locality, lentic	26 (2)
	182. *Agabus inexspectatus*	1 locality in Alaska, lentic	8 %

ecozone, the Boreal Shield, has the largest fauna, but is hardly different from the Montane Cordilleran and Boreal Plains. In the western Cordillera there is an increase in species richness of ecozones from the northern Taiga Cordillera through the Boreal Cordillera to the Montane Cordillera Ecozone. However there is also a corresponding increase in area and collecting intensity from north to south. This pattern is no doubt real but probably not as strong as the data here presented indicate.

Rather than a simple species count, a better way of analysing faunal patterns is to ask how unique is the fauna of each ecozone? The species unique to each ecozone are listed in Table 3. On this basis the Mixedwood Plains of Southern Ontario and Quebec has the largest number of species unique to the Canadian fauna. However, each of the Ecozones that border the United States have some unique species most of which are adventitious or southern species that reach their northern limits within the Ecozone. The Arctic Ecozone has two unique but very poorly collected species. Of these various unique species, only *Agabus margaretae* (Plains) and *Stictotarsus minipi* (Taiga Shield) are known from nowhere else in the world. The remainder are species occurring mainly outside of Canada and reaching their range limits within the ecozone.

An often overlooked but ecologically more important aspect of the fauna are those species that are widespread and abundant. It is difficult to measure abundance, but based on the number of ecozones they occupy, species can be ranked on the basis of how widespread they are. The most widespread species in Canada are (species numbers as in Tables 1 and 2):

Present in 13 ecozones (3 species):

105. *Hydroporus notabilis*; 117. *H. striola*; 129. *Stictotarsus griseostriatus*.

Present in 12 ecozones (9 species):

4. *Laccophilus biguttatus*; 155. *Agabus anthracinus*; 174. *A. erichsoni*; 216. *Ilybius angustior*; 237. *Rhantus binotatus*; 251. *Dytiscus alaskanus*; 254. *D. dauricus*; 266. *Acilius semisulcatus*; 272. *Graphoderus perplexus*.

Present in 11 ecozones (14 species):

35. *Hygrotus impressopunctatus*; 47. *H. picatus*; 95. *Hydroporus fuscipennis*; 114. *H. signatus*; 120. *H. tenebrosus*; 122. *H. tristis*; 161. *Agabus bifarius*; 168. *A. confinis*; 170. *A. discolor*; 184. *A. inscriptus*; 198. *A. phaeopterus*; 203. *A. seriatus*; 252. *Dytiscus circumcinctus*; 256. *D. harrisii*.

Present in 10 ecozones (13 species):

7. *Laccornis conoideus*; 90. *Hydroporus dentellus*; 102. *H. morio*; 160. *Agabus bicolor*; 201. *A. semipunctatus*; 207. *A. thomsoni*; 208. *A. tristis*; 220. *Ilybius discedens*; 224. *I. picipes*; 227. *I. subaeneus*; 236. *Neoscutopterus hornii*; 242. *Rhantus suturellus*; 243. *R. wallisi*.

Its difficult to make many generalizations from this list. *Stictotarsus griseostriatus* is a colonizing species that flies readily and is quick to colonize newly formed ponds. Possibly this applies to the other two most widespread species. There are few lotic species in the list, the most notable being *Agabus seriatus* and *Rhantus binotatus*, although the latter also occurs in ponds. The majority of species in 11 and 12 ecozones are species that occur in the emergent zone of small, standing water habitats, and are usually in moderately rich to rich sites. On the other hand, the species of 10 ecozones are principally peatland species and reflect the wide distribution of peatlands in Canada.

Dytiscidae and the Environment

The process of assessing environmental conditions in an area, especially with regard to some human perturbation, often involves examining the local biota. The animals present demonstrate that the range of conditions lie within their tolerance limits, and if these are known something can be said about the nature of the environment. Different types of animals with different ecological characteristics can provide diverse types of environmental information. Water beetles have been little used in these studies. Young (1961) was one of the first to propose studying water beetles as a means of detecting pollution. Their value lies in the fact they are long-lived and therefore would indicate environmental conditions over a period of at least months. They are taxonomically and ecologically diverse. Larson (1985, 1997*c)* has shown that within many genera species form replacement series along environmental gradients so that there may be potential for calibrating the tolerance of each species and using them as gauges of the range of conditions. Also, water beetles occur in habitats such small pools and springs where there are not many other suitable indicator forms and therefore may complement other taxa so that in total these groups span the range of aquatic habitats.

There has been considerable concern about the conservation of water beetles and their habitats in Europe (Foster 1990; Foster *et al.* 1992). To date this has not been a major concern in North America where knowledge of the fauna is still developing. Humans have had major effects on water beetles. Draining wetlands certainly reduces their abundance and diversity. Channelization, siltation, changing vegetation near water, and chemical pollution and use of insecticides negatively affect the fauna. On the other hand people do many things that increase water beetle habitat. One of the best types of habitat for water beetles is beaver dams. People mimic beavers in many ways by blocking small streams and cutting down large shading trees so that emergent plants can grow up in shallow waters of recently flooded ground. An environmentally irresponsible forest clear-cut often leaves a much richer fauna in the machinery tire track pools, blocked streams and more sun exposed pools than were present in the undisturbed area.

Most water beetles are largely adapted to unstable environments and habitat instability, within limits, promotes their populations. It is the relatively few species that are habitat specialists, mainly those in springs, that are most at risk. The greatest threat that water beetles are exposed to at present is the rather innocuous appearing grazing of cattle. Through removing emergent and bank-side vegetation, dropping manure into water and generally degrading the banks of both ponds and streams through trampling they dramatically change conditions for the insects. Also, cattle seek out all parts of the environment to which they have access so the concept of remote refuges does not apply to their impacts. *Oreodytes quadrimaculatus* appears to have been lost from some Alberta foothill streams as cattle have destroyed the overhanging banks and increased siltation. *Hydroporus carri*, a Rocky Mountain spring species, does not tolerate trampling of the springs and has disappeared wherever grazing is intense. On grasslands, the vernal pools species *Agabus margaretae* and *A. triton* are very uncommon, known only from the few pools that were not grazed. The fate of these species will depend upon the establishment of protected grasslands.

Collecting and Sampling Water Beetles

Even the most casual observer standing beside a small pond notices water beetles. Larger beetles can be seen to swim through open spaces between plants and beetles of varied size dart to the surface to renew their air supplies. Specimens spotted in these activities can be captured with a swift sweep of a sieve or aquatic net. However, those beetles visible to the eye represent only a small portion of the fauna present. Most beetles are within tangles of vegetation or mats of plant debris or burrow into the bottom. Also, many are mainly nocturnal and thus are not active when it is possible to observe them. In order to get a good perspective on the fauna, sampling has to be done within the various habitat types.

The most basic collecting technique is drawing an aquatic sweep net over the bottom and through vegetation and accumulations of debris. The more vigorously this can be done the more successful it is. Standard dip nets are too fragile to stand up to the strains, abrasions and snags encountered. The best commercial net we have found is the Wards Indestructible Dip Net. The frame is heavy enough that it does not bend with vigorous sweeping, the net bag is fastened to the frame in a way that reduces abrasion of the cloth and the mesh is protected and strong enough to resist catching and tearing on branches and stones. A net bag of nylon 1 mm mesh is generally satisfactory for it allows water to pass through rapidly without back pressure as well as passing silt and flocculent organic material readily. It will retain most dytiscids although some bidessines can crawl through the meshes. A useful modification of this net is one in which the handle is replaced with two sections of 25 mm outside diameter aluminum pipe which screw together and onto the net frame so that the net can be disassembled into three pieces each about 50 cm long and can easily fit into a suitcase, pack or small compartment in a car. Such a collapsible net can be easily carried almost anywhere and yet provide a good robust tool that will stand much abuse.

Water beetles are usually in protected sites or take refuge on being disturbed. At any rate, the greater the habitat disturbance during collection, the more beetles that are collected. In dense emergent vegetation, it is almost impossible to draw or push a net through the plant stems vigorously enough to catch many beetles. It helps to wade amongst the plants, depressing them with the feet and roiling up the bottom then sweeping quickly through the disturbed area. A single pass of the net is seldom enough, repeated passes of the net over the same spot often produce increasingly good catches and it takes a lot of sweeping to exhaust a spot. Similar techniques work as well in even structurally simple habitats such as over sand or gravel. Stirring up an area either with ones feet or repeated net sweeps often dislodges beetles that are missed when a net is simply dragged over the bottom. This form of collecting can be damaging to vegetation and it is recommended that it be applied with discretion, especially in small habitat patches. Although there seems to be little evidence that damage is long-term, small specialized habitats, such as the eye of a spring, could be modified enough by collecting to have serious effects on their populations of insects.

Beetles captured in the net can be simply picked out of the bag. However there is usually considerable debris in the net and if the beetles remain immobile, as they often do, even the largest specimens may be overlooked. Therefore it is desirable to dump the net contents into a white basin or onto a sheet where they can be carefully searched. Generally the warmer the water the more active the beetles and the more easily they are discovered. Most beetles will crawl around the collecting basin but some specimens, especially tropical *Copelatus*, fly readily and will fly from the net even as it is lifted from the water. In colder environments the problem is the opposite, captured beetles do not move and are therefore very difficult to spot. In sunny weather the net debris can be spread out so that heating and drying by the sun causes the insects to move. A variation on this is to place a one-quarter (6 mm) to one-half (13 mm) inch wire screen over a white basin then spreading the net contents over the screen (Hilsenhoff and Tracy 1985). When beetles move, they fall through the mesh and into the basin where they are easily seen. Some of the most difficult beetles to collect are certain bog and spring inhabiting species that occur in cold water of habitats with vast amounts of organic silt and moss. Slow, careful sorting through the material and patience are required but the collector is often well rewarded with some of the least known and more unusual species.

Sweep net collecting provides a qualitative assessment of the fauna present but does not give good data for population assessment. Larson and House (1990) and Larson (1997*c)* described ways in which sweep net collection was systematized to give measurements of insect density. Larson and House restricted sweeping to within an area of one square metre whereas Larson swept repeatedly along a transect of one metre length. In both these techniques boundaries of the sampled areas were open so that beetles could escape by swimming out or beetles from neighbouring areas could be sucked in by the passing net and subsequently caught. These difficulties make absolute evaluation of the results difficult yet the techniques are simple and do standardize effort so that results are comparable and were shown to demonstrate meaningful patterns. Using a barrier to circumscribe the collecting area would increase the accuracy but would very much limit versatility especially in sites with dense vegetation or deep organic silts.

Sweep net collecting, especially if conducted for several hours within a given habitat, yields a good assessment of the habitat faunal composition. However, some larger species occur in low densities or are adept at avoiding the net and therefore may be present in a site but missed by the collecting. Also, many water beetles are probably nocturnal (Holomuzki 1985) and tend to be missed during hours of light. Various authors advocate trapping water beetles. The traps are generally based on the inverted funnel design of minnow traps. The beetle swims into the mouth of a funnel which directs it through the small aperture and into a collecting chamber from which the insect finds it difficult to exit. Hilsenhoff and Tracy (1985) give a good review of the various types of traps that have been used. Hilsenhoff (1987, 1991) compared catch of sweep net sampling with those of bottle traps and demonstrated the utility of trapping for sampling larger taxa but smaller species are probably best collected by sweep net. However, Mölle (1998) has designed a more sophisticated trap that intercepts beetles on the way to the surface and appears to be more effective at catching smaller forms as well as having the ability to assess density. Most traps probably give better information on beetle activity than on density. However, Aiken and Wilkinson (1985) used traps in a mark–recapture study to estimate population size and movement of *Dytiscus alaskanus*.

Microsampling techniques using small cylinders to delimit an area of habitat from which all specimens are collected probably provide the most accurate assessment of population densities. However, shortcomings are the cores are either not effective or are very labour intensive when used for studying species occurring at low densities (which are the majority of species in any habitat) or which have highly clumped distribution (another complicating feature of most animal populations).

Water beetles often fly to electric light (especially black light—light rich in ultraviolet radiation) at night. Good collections can be obtained from light traps, by picking the insects off a white sheet placed behind a light or even from the ground beneath street lights. A few species are known from Canada only or mainly from light collected specimens. Within almost any area of southern Canada light collection will likely produce new records of species dispersing from southern localities. Different species disperse at different times of the year so that over the summer the species composition of collections changes. Best catches are generally in late summer and on warm fall evenings. There are extensive dispersal flights of dytiscid beetles in the spring also but because of cool nights and the long spring and early summer days, much of this dispersal is diurnal so collecting at light misses much of it. However, these insects will often land on shiny surfaces such as cars, asphalt or plastic sheets, apparently responding to the reflection as though it was from water. Picking landing beetles off a car is sometimes productive on a warm spring day. The tendency of the various species to fly varies so that light collection gives a skewed representation of the fauna of an area.

In general, most ecological studies on water beetles have focussed on community ecology, occurrence of species across various sites, or temporal occurrence of adults. The data for these studies, generally presence or absence, are fairly readily obtained. There are fewer population studies and even fewer that treat larvae quantitatively as the more delicate nature of larvae and their often short period of occurrence in the field make them even more difficult to sample than adults. Population level studies integrating all life history stages are the one of the greatest needs in water beetle ecology.

PART 2. ADULTS

TAXONOMIC CHARACTERS and METHODS

Below we describe certain taxonomic characters and terms. This section is sequenced in the order in which characters are treated in the descriptions, that is general features of size and habitus, color, sculpture and structural features from anterior to posterior on the body and dorsal to ventral. Many authors have discussed taxonomic structures of dytiscid beetles, some of the most detailed of these being Sharp (1982*a)*, Balfour-Browne (1940, 1950) and Franciscolo (1979*a)*. Generalized diagrams of dytiscid beetle morphology are presented in Fig.1

Size Measurements and Shape. A single measurement taken from the anterior margin of the clypeus to the elytral apex was used for total body length (length). Although curvature of the body, generally extension of the head, may affect this measurement, in several tests the coefficient of variation (cv) in length was no greater than the cv of length of elytron. Therefore the single measurement of body length is used to indicate size. Length is often a very useful character for species recognition and also provides a convenient way to divide the species of some large genera (*Hygrotus*, *Hydroporus*) into manageable groups in keys. When length has been used as a key character, allowance has been made for the most extreme geographical and individual variation observed and species whose members straddle the key length are treated under both alternatives.

Width of the body was measured at the widest point. It is used with length as a ratio (length: width) which is useful for description of body shape. Short, oval species may have a length: width ratio as low as 1.45 whereas elongate species may have a ratio of 2.10 or more. Shape is also described qualitatively. For instance, specimens of some species have the lateral outline interrupted in dorsal aspect. The degree of curvature of the lateral margin of the pronotum determines whether it meets the lateral margin of the elytron in a smooth arc (lateral outline termed continuous) or if there is a discontinuity in curvature between the pronotum and the elytron (lateral outline discontinuous). Specimens of some species have the lateral margins of the elytra distinctly parallel-sided basally, in others the elytral outline is broadly ovate and tapers anteriorly and posteriorly from the widest point. Outline drawings of the left side of the body in dorsal and lateral aspects are presented to illustrate these characters for selected species.

Most dytiscid beetles are somewhat flattened dorsoventrally and the body is referred to as being variously depressed. The degree of flattening of a few species is described quantitatively as a ratio of length: depth. Body depth is measured at right angles to the longitudinal axis of the body in lateral aspect and is the point of maximum distance between the dorsal surface and the ventral surface, excluding the legs.

Color. Color is very useful for the recognition of many species. Differences in color between related species may be subtle but with careful attention to detail, color often provides accurate and easily observed characters for identification. In order to examine color, specimens should be clean and examined under a strong light. Pale spots on the elytra of some specimens may be visible only when the elytra are lifted so that light shines through areas of reduced pigment. The color of teneral specimens (immature specimens in which the cuticle is not fully hardened and darkened) must be evaluated

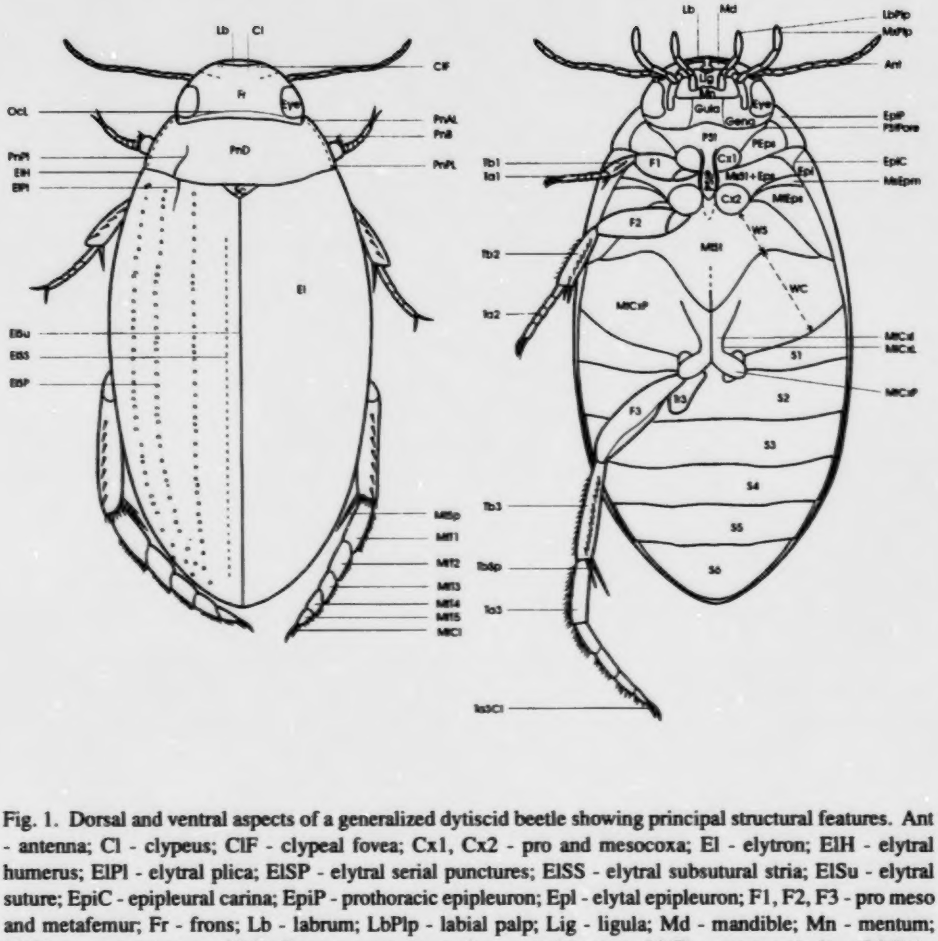

Lb
Cl
ClF
Fr
Eye
OcL
PnAL
PnB
PnPl
PnD
PnPL
ElH
ElPl
El
ElSu
ElSS
ElSP
MtSp
MtT1
MtT2
MtT3
MtT4
MtT5
MtCl
Lb
Md
LbPlp
MxPlp
Ant
Lig
Mn
Gula
Gena
Eye
EpiP
PStPore
PSt
PEps
Tb1
Ta1
F1
Cx1
EpiC
MsSt+Eps
Epl
MsEpm
Cx2
MtEps
F2
WS
MtSt
Tb2
WC
MtCxP
Ta2
MtCxI
MtCxL
S1
MtCxP
Tr3
S2
F3
S3
S4
Tb3
S5
TbSp
S6
Ta3
Ta3Cl

Fig. 1. Dorsal and ventral aspects of a generalized dytiscid beetle showing principal structural features. Ant - antenna; Cl - clypeus; ClF - clypeal fovea; Cx1, Cx2 - pro and mesocoxa; El - elytron; ElH - elytral humerus; ElPl - elytral plica; ElSP - elytral serial punctures; ElSS - elytral subsutural stria; ElSu - elytral suture; EpiC - epipleural carina; EpiP - prothoracic epipleuron; Epl - elytal epipleuron; F1, F2, F3 - pro meso and metafemur; Fr - frons; Lb - labrum; LbPlp - labial palp; Lig - ligula; Md - mandible; Mn - mentum; MsEpm - mesepimeron; MsSt+Eps - mesosternum plus mesepisternum; MtCl - metatarsal claw; MtCxi - metacoxa, interlinear space; MtCxL - metacoxal line; MtCxP - metacoxal process; MtCxPl - metacoxal plate; MtSp - metatibial spur; MtSt - metasternum; MtT1...5 - metatarsomeres 1 - 5; MxPlp - maxillary palp; OcL - occipital line; PEps - proepisternum; PnAL - pronotal anterolateral angle; PnB - pronotal lateral bead; PnD - pronotal disc; PnPL - pronotal posterolateral angle; PnPl - pronotal plica; PSt - prosternum; PStP - prosternal process; PStPore - prosternal pore; S1...S6 - visible abdominal sterna 1 to 6; Ta1, Ta2, Ta3 - pro-, meso-, and metatarsus; Tb1, Tb2, Tb3 - pro-, meso-, and metatibia; TbSp - tibial spur; Tr1, Tr2, Tr3 - pro-, meso-, and metatrochanter; WC - width of metacoxa; WS - width of metasternal wing.

with care as these are paler than mature specimens. On the other hand, teneral specimens often have the pattern of markings enhanced and more easily seen than on darker mature specimens.

Pure colors such as yellow, red or brown seldom occur, rather they usually show some degree of darkening referred to as infuscation. Infuscation may be generalized over a given body region or, more frequently, localized. For example, the apex of the antenna is often infuscate which means it is darker then the basal portion. Color terms used in the text include: testaceous—brownish-yellow; rufous—reddish with a mixture of brown or black; piceous—pitchy, very dark rufous to almost black but with a reddish cast; aeneous —a metallic green to bluish sheen.

Although most adult dytiscids are of rather sombre, dark color, some species are very strikingly marked. Terms used to describe color patterns include: irrorate—freckled, covered with minute spots; vittate—with longitudinal markings (vittae); fasciate—markings (fasciae) with their longitudinal axis at right angles to the longitudinal axis of the body. Vittae and fasciae may be either pale or dark, this depending upon the background color of the body against which they occur. There are several types of pale markings that are of widespread occurrence and probably reflect the ancestral color pattern. Almost all species have a pair of pale frontal spots on the frons between the eyes. These spots may be separate, fused medially to form a transverse bar or an inverted V (chevron) and may be connected medially with a pale anterior margin of the head. The elytron of many species is dark with pale spots located laterally or sublaterally on the shoulder, just posterior to the middle and near the apex. These spots may be variously expanded transversely onto the disk (fasciate) or may be longitudinally confluent to produce a vittate pattern. The elytron of some species is mainly pale with separated longitudinal dark vittae adjacent to the suture (sutural vitta) and on the elytral disk along the lines of the serial punctures (discal vittae are numbered from sutural side of elytron).

Sculpture and Punctation. We find that clear observation of sculpture is easiest on specimens that are pinned. However, to see details of sculpture clearly, it is essential that the insect be clean of grease and dirt. It is advisable that when specimens are mounted they first be washed in a mild detergent, rinsed in water then 95% ethanol and then dried enough that when the pin passes through the body, body fluids do not seep out over the cuticle. It is necessary to examine punctation and sculpture under diffused light which eliminates bright reflections from the cuticle. This can be achieved by placing an opaque piece of drawing plastic between a high intensity microscope light and the specimen as a diffusion screen, or by examining specimens by the light of a "soft light" 100 W incandescent bulb placed close to the specimen. Details of sculpture may also be observed on fluid preserved specimens but is essential that the beetle be completely submerged in clean alcohol for viewing. A disadvantage of examining a specimen in alcohol is that it is more difficult to manipulate than a dry specimen on a pin.

The surfaces of sclerites are seldom smooth, rather they usually bear impressed lines and pits or punctures. The basic sculpture is fine, closely spaced lines that produce a network of small cells or meshes that are referred to as microreticulation. Many species have a coarser set of lines which appear to be derived from deepening of some of the lines of the basic microreticulation. These lines in turn form coarser meshes of varied size and shape. Meshes of rounded or hexagonal shape and similar size are termed isodiametric. More frequently meshes are irregularly shaped polygons of varied size, or meshes have a longitudinal or transverse orientation which are described as stretched in a particular direction. Descriptions treat the coarsest meshes first (those visible under lowest magnification) then the pattern of sculpture within these meshes (visible at higher magnification). Lines of sculpture, and therefore meshes, may be deeply impressed, shallow or partly (obsolete) to completely effaced. Some specimens have short, deep, isolated lines which are termed strioles or aciculate sculpture.

Sexual dimorphism in sculpture occurs in many species. In such species the female is more coarsely reticulate and the reticulations can be dense enough to obscure punctation and coarser lines. It has often been necessary to treat males and females of such species separately in keys because characteristics useful for male identifications are not visible on the females. Females of some species of *Dytiscus* and *Acilius* have longitudinal grooves or sulci on the elytra. In various genera, including *Copelatus, Rhantus, Graphoderus* and *Hydaticus*, many females have short, deep strioles or anastomosing lines on the pronotum and elytron.

Dytiscid beetles have fixed series of setae-bearing punctures on the dorsal surface of the body. These series are situated along the inner margin of the eye, along the margins of the thorax and as longitudinal series on the disc and lateral margin of each elytron. Descriptions of these punctures have often been included in species descriptions in the past but with only a few exceptions we have found them to be of too regular occurrence to have much value in defining taxa. A variety of other types of punctures occur, and those of hydroporines were discussed by Wolfe and Zimmerman (1984). Punctures may be minute and barely visible at 50 to 100 magnifications (micropunctures) or may be very large and deep making the surface strongly pitted. Most punctures are compound with a trichoid sensillum that may be situated in a concentric or eccentric position. In general, we do not distinguish among types of punctures but refer to relative size (larger or smaller), depth (coarse to fine) and distinctness (distinct to obscure) of punctures. Dual punctation refers to the occurrence of punctures of two distinct size classes. Density of punctures is often expressed as average distance between punctures measured in terms of average puncture diameter. The body surface may appear free of setae (except for the fixed series), have minute setae or be evidently setose. Setae length is often described in relation to the average distance between the bases of adjacent setae.

The term stria(e) is used in a restricted sense in that it is applied only to longitudinal impressed lines or furrows on the elytra. Examples are the discal striae of *Copelatus* species or the subsutural stria of the elytra of some bidessines. Other terms are used for impressed lines on other parts of the body. For example, the line that crosses the head of some bidessines at the level of the hind margin of the eye is referred to as the occipital line. The pronotum and base of elytron of many bidessines and pronotum of some hydroporines have lateral or basolateral longitudinal impressions that are generally limited laterally by a more or less elevated ridge. These are called plicae.

Head. The size of the eyes varies within the family. A few subterranean beetles lack eyes, whereas a few species have very large, convex eyes. In most species the eyes form a more or less even lateral curvature with the sides of the head. In anterior aspect, the inner margin of the eye may be straight (Dytiscinae) or the lateral margin of the frons above the base of the antenna may impinge on the eye to produce a distinct emargination. Some specimens have one or more distinct frontal punctures on each side of the frons at about the level of the anterior margin of the eyes. Several genera of Bidessini are characterized by the presence of an occipital line that crosses the dorsal surface of the head posterior to the eyes.

The most used mouthpart characteristics are the shapes of the palpomeres. Their relative lengths and shape of the apices define several genera. Mandibles vary in shape within the family but because they must be removed in order to be seen clearly, they have been used little for classification. The antennae are composed of eleven antennomeres. In most species they are filiform but in some the antennomeres are short and oval and therefore more or less moniliform. Male specimens of several taxa have one or more antennomeres broadened.

Thorax. The pronotum is roughly trapezoidal in shape. The anterior margin is variously indented or emarginate (anteromedial emargination) for the reception of the head. The anterolateral angles protrude anteriorly adjacent to the eyes. The posterolateral angles of the pronotum are generally distinct and more or less right angled but they may be rounded and obtuse or may be produced backwards and acute. The hind margin may be more or less truncate, evenly rounded or produced medially as a distinct medial lobe which may or may not hide the scutellum. Laterally, most specimens have an engraved line parallel to the lateral margin and delimiting a lateral bead. The medial area of the pronotum is referred to as the disc, on which there are submarginal series of coarser punctures and there may also be a medial impression (fovea) or sublateral or basolateral plicae. In lateral aspect, the sides of the pronotum may be curved downwards to hide the lateral proepipleuron (lateral sclerite of the prothorax lying above the prosternum), or the proepipleuron may be partly or totally visible.

The elytra are of rather simple form. The straight inner margin is referred to as the sutural margin and multiple longitudinal features of the disc (vittae, striae) are numbered outwards from the sutural margin. The disc has three or four longitudinal series of setiferous punctures (serial punctures). Aside from the usual sculpture, the disc is smooth although some species have longitudinal depressions (sulci or striae) or raised areas (ridges or carinae). The anterolateral angle of the elytron behind the pronotum is the shoulder or humeral angle. In lateral aspect the lateral margin may be more or less straight from near the middle (approximately opposite the metacoxal processes) to the humeral angle; it may be distinctly curved with the margin rising near the shoulder (elytron ascendant), or be sinuate, i.e. ascendant with a slight bend to the horizontal at the shoulder. The epipleuron, ventrolateral portion of the elytron below the lateral margin, varies in width and length; in some specimens it is crossed by a transverse ridge or carina at the shoulder.

Characters in the structure of the prosternum are of value in classification of dytiscid beetles at all ranks. The prosternum is produced medially between the procoxae as the prosternal process which in most specimens is cradled by lateral processes of the mesosternum and extends posteriorly to contact the anteromedial lobe of the metasternum between the mesocoxae. The narrow portion of the prosternal process between the procoxae is the neck of the process and the broadened area behind the procoxae is the blade. Laterally the process has a raised margin or bead. The apex of the blade may be drawn out into a needle-like point (acuminate), be sharply or bluntly pointed, or be truncated apically. In lateral aspect, the midline of the prosternum anterior to the procoxae and the midline of the prosternal process may lie in a single, continuous plane or the neck of the process may be declivous (sloping downward) between the procoxae so that the blade is on a lower plane than that of the prosternum (Hydroporinae). Within the Hydroporinae, the declivous portion of the process may bear transverse ridges termed the prosternal file behind which is a variously developed ridge or tubercle termed the prominence. The length of the prosternal process varies. In a few species it does not contact the metasternum and the mesocoxae are contiguous medially. However, in most species it separates the mesocoxae and contacts the metasternum, often being received into a depression or groove.

The metasternum is a transverse sclerite that encloses the hind margin of the mesocoxae and lies anterior to the large metacoxae. Laterally it extends as a triangular or arch-shaped piece, the metasternal wing, which terminates in a point or small lobe between the anterolateral margin of the metacoxal plate and the metepisternum. Within some genera, the width of the metasternal wing varies between species and provides a good character for species recognition. The width of the metasternal wing is expressed quantitatively as a ratio of the minimum width of the metasternum between the meso- and metacoxae (WS, measured inside the bead of the mesocoxal margin) divided into the width of the metacoxal plate measured along an extension of the same line (WC).

The hind legs articulate with the posteromedial portion of the metacoxae. These articulations are separated medially by the paired metacoxal processes which lie on either side of the midcoxal line. The posterolateral angle of each metacoxal process may be emarginate so that the leg base is entirely exposed or it may be rectangular or produced into a rounded lobe that variously hides the leg base. In ventral aspect, the hind margin of the metacoxal process may be truncate, extended or notched along the midcoxal line, or be variously emarginate or notched on each side of the midcoxal line. In lateral aspect, the apex of the process may be adpressed and more or less fused to the following abdominal sternum or it may be raised and on a distinctly lower plane. Coxal lines originate on the metacoxal processes and run forwards, separating the lateral metacoxal plate from the midcoxal area (intralinear area). These lines may be more or less straight but in most specimens they converge anteriorly to the metacoxal processes then diverge again as they approach the metasternum.

Legs. Characteristics of the legs are generally the best way of separating the sexes and as well provide numerous characters for species recognition. In descriptions of the front and middle pairs of legs, the legs are assumed to be stretched out at right angles to the body and in this position the surfaces are described as dorsal, ventral, anterior and posterior. The hind coxae are fused to the metathorax in such a way that the hind legs are rotated so that the true anterior face of the metafemur and metatibia has become the ventral surface. The metatarsus is further rotated so that its anterior face is dorsal. In descriptions of hind legs the terms dorsal, ventral, anterior and posterior refer to the apparent position of the leg. Certain leg segments may be fringed with long swimming hairs (natatorial setae). The presence or absence of these setae from certain leg segments may distinguish between sexes or species. Males of some species have these setae densely elaborated to form brushes. The hind legs are highly varied in the degree to which they are modified for swimming. Many hydroporines have slender legs whereas some dytiscines have the hind legs very broadly expanded to function as sculls. An index of the shape of a leg is sometimes given as a ratio of the length to the width of the femur or tibia, or the ratio of the lengths of various leg parts (e.g., length of femur to length of trochanter; length of tibial spur to length of tarsomere 1). The metatarsomeres vary considerably in shape, from elongate and slender to short and broad. The apical margin may be truncate to strongly lobed and may or may not have a fringe of setae. The metatarsal claws may be similar in length and shape, the dorsal (anterior) claw may be shorter than the ventral claw or it may be lacking.

Characteristics of the protarsus of value in separating the sexes include the degree of dilation of protarsomeres 1 to 3, the ventral vestiture of these tarsomeres and the shape of the protarsal claws. Male specimens usually have protarsomeres 1 to 3 broader than those of the female. The most extreme situation occurs in members of the subfamily Dytiscinae where these three tarsomeres conjointly form a round to oval plate that ventrally bears adhesive discs. The nomenclature of this structure is confused. The conjoint structure formed from the close association of protarsomeres 1 to 3 has been called a palette (Aubé 1836), patella (or patelliform) (Crotch 1873), plate (Sharp 1882*a*; disc (Balfour-Browne 1950), suction disc (Young 1954), oval plate (Leech and Chandler 1956), pallette (Larson 1975; Nilsson 1986*c*), acetabulum (Roughley 1990), or simply protarsus (Hilsenhoff 1993*a*). The adhesive setae on the ventral surface have been called cupules (Aubé 1836), cups or palettes (Sharp 1882 *a*; Roughley 1990; Hilsenhoff 1993), suckers (Balfour-Browne 1950), suction cups (Young 1954), ventral adhesion discs (Leech and Chandler 1956), adhesive discs (Larson 1975; Nilsson 1986*b*) and suction discs (Aiken and Kahn 1992). In this work we use the term palette for the round to oval conjoint structure formed by the close association of protarsomeres 1 to 3 of male specimens of the subfamily Dytiscinae. A palette is a thin oval or round artists plate held in the hand and used for holding and mixing paint. This oval, hand-held plate is a very suitable analogy for the large tarsal plate at the apex of the foreleg and therefore this use of the term conjures up a very good picture of the structure. In order to quantify the width of the protarsomeres, the maximum dorsal width of various tarsomeres as well as the maximum width of the protibia near its apex were measured. Tarsomere widths may be expressed in terms of actual measurements (e.g., mm, *Hydroporus*), as ratio to the maximum width of the anterior face of the protibia measured at right angles to its longitudinal axis (protibia width) (e.g., *Laccornis*, *Hydroporus*) or as ratios of protarsomere widths amongst themselves (e.g., ratio of each of protarsomeres 1 to 4 to medium width of protarsomere 5, *Agabus*). In males of most species, the ventral surface of protarsomeres (and often mesotarsomeres) 1 to 3 bear modified setae which help the male adhere to the female's back during mating. We use the term adhesive setae for all types of suction or adhesive structures on the ventral surface of male pro- and mesotarsomeres of all taxa of Dytiscidae. These structures vary in size and shape but all appear to be derived from setae in which the distal end has become enlarged and modified for adhering to the surface of the female. The different types of adhesive setae are designated on the basis of size and shape of the apical expanded portion. Tarsal vestiture is subject to loss or damage and is obscured if the tarsi are at all dirty.

The form of the protarsal claws is useful for the recognition of males of many species. Male protarsal claws are illustrated in anterior aspect for many species. Female protarsal claws are not modified and have not been found to provide useful characters although the length of the claws relative to the length of protarsomere 5 may prove useful.

Abdomen. The abdomen of a pinned specimen appears as six sternites. The first visible sternite which is divided medially by the metacoxa and appears as a triangular sclerite on each side, is actually a sclerite of abdomen segment 2. However, we number the sterna on the basis of what is visible, therefore the abdominal sternites are referred to a sterna 1 to 6 (belonging to true segments 2 to 7). Segments 8 to 10, which bear the sclerotized genitalia, are invaginated and not normally visible. The genitalia must be viewed either by extruding them (possible only in freshly killed specimens) or dissecting out the invaginated segments. The male genitalia provide valuable characters for classification at all levels; the female genitalia are most useful for defining supraspecific groupings although some valuable specific characters have been found in the few taxa that have been adequately studied (e.g., Hilsenhoff 1994).

The male genitalia consists of three lobes, a median aedeagus and lateral parameres. Paramere shape varies considerably, they may be symmetrical or asymmetrical, elongate or short, setose or glabrous and of highly varied shape. The aedeagus in its simplest form is like a simple curved rod. It is expanded basally (basal piece) with a condyle to which the parameres articulate and expanded posterior apodemes to which muscles from the parameres attach. In repose, the genitalia lies on its side but on extension it rotates so that the aedeagus extends posteroventrally. In this extended position, a membranous groove lies along the upper surface and is considered to be the dorsal side. Left and right sides are also designated in relation to the extended position. The aedeagus of most species is bilaterally symmetrical but in some species it is variously asymmetrically twisted or produced. Because of the importance of the aedeagus in identification of many species, it is recommended that when specimens are pinned, the genitalia of at least one male of each species be removed and glued to a card pinned with the specimen. The aedeagus should be glued in such a way that the shaft and apex are clearly visible and stand clear of the card base.

The most prominent part of the female genitalia are a pair of gonocoxae (or genital valves). These are generally elongate and triangular in form. In many taxa they are laterally flattened, moderately sclerotized and bear short setae. However, there are many modifications, for example in some forms they may be sclerotized and glabrous forming a sword-like structure (e.g., *Dytiscus*) or bear saw-like teeth (*Ilybius*). Below and between the gonocoxae are the variously developed appendages of segment 8. In *Laccophilus* and *Agabetes* these appendages are fused and elongate and ventrally bear saw-like teeth.

Distinguishing Sexes. Differences between sexes have been noted above in the descriptions of the various character sets. The protarsus offers the most easily seen character for separating the sexes in most species. The basal two or three protarsomeres of the males are usually broader (slightly to greatly expanded) than those of the female and/or bear several to many enlarged sucker hairs on the ventral surface which are lacking in the female. Females of many species have stronger body sculpturing than males, for example microreticulation may be more deeply impressed and lines denser, punctation may be deeper and/or denser or the dorsal surface may have grooves, strioles or other impressions lacking on the male. In only a few species are the sexes indistinguishable without recourse to examination of the genitalia.

CLASSIFICATION OF DYTISCIDAE OF NORTH AMERICA NORTH OF MEXICO

The key to subfamilies presented below reflects modern concepts of subfamilies of Dytiscidae as they are understood for the North American fauna. We regard the Noteridae as a separate family but include it in the key as some authors (e.g., Pederzani 1995) consider it a subfamily of Dytiscidae. Most publications recognize four traditional subfamilies: Laccophilinae, Hydroporinae, Colymbetinae and Dytiscinae. However, we recognize the additional subfamilies Hydrotrupinae, Agabetinae and Copelatinae, all of which are removed from the former Colymbetinae. The rationale for these divisions is discussed briefly in the Comments section after the diagnosis of each subfamily. In summary, however, most of these additional subfamilies are rendered necessary due to cladistic analysis of the subfamilies and/or because of compelling differences in larval structure. Within the key are listed the number of genera and distribution of each subfamily within North America north of Mexico.

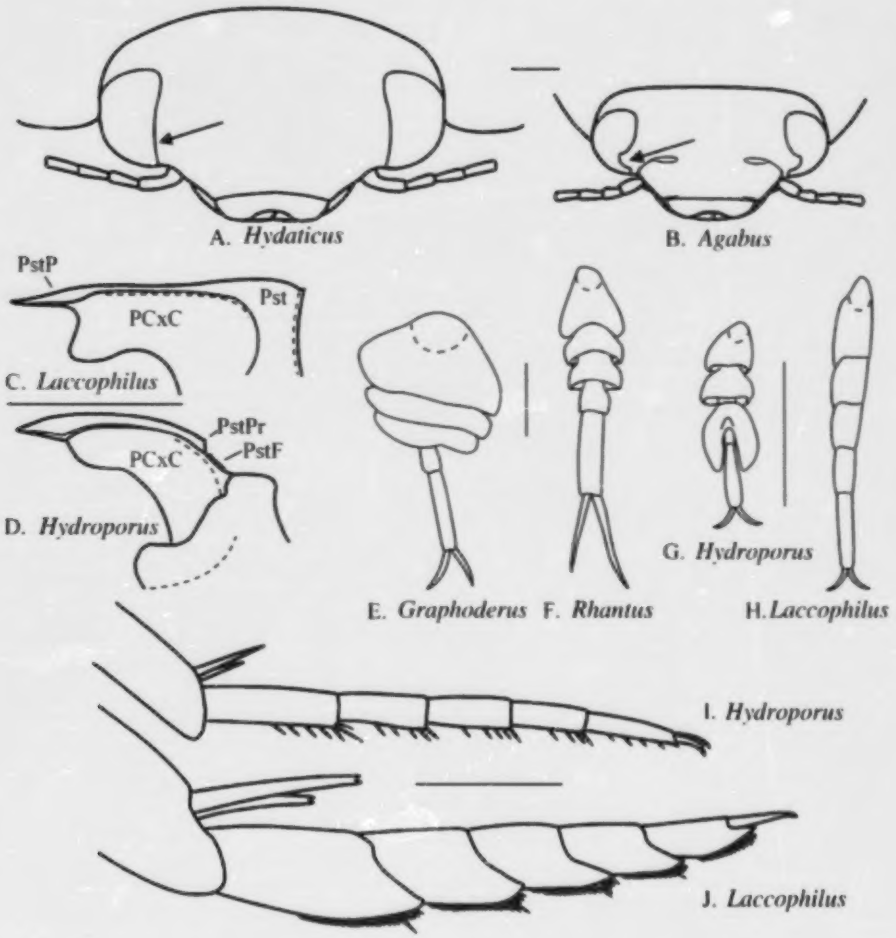

A. Hydaticus
B. Agabus
PstP
PCxC
Pst
C. Laccophilus
PstPr
PstF
PCxC
D. Hydroporus
E. Graphoderus
F. Rhantus
G. Hydroporus
H. Laccophilus
I. Hydroporus
J. Laccophilus

Fig. 2. A, B - head, anterior aspect, arrow showing no emargination (*Hydaticus*) and emargination (*Agabus*) of anterior margin of eye. C, D - prosternum, lateral aspect and ventral side up; PCxC - procoxal cavity; Pst - prosternum; PstF - prosternal file; PstP - prosternal process; PstPr - prosternal prominence. E - H - male protarsus, dorsal aspect. I, J - metatarsus, dorsal aspect; I - nonlobed; J - lobed. Lines = 1 mm.

Key to subfamilies of Dytiscidae of North America

1. Metacoxal process raised above metacoxal plate for its entire length and continuous with mesal portion of metasternum to form a common ventral plate that lies in the same plane as broad, nearly truncate apex of prosternal process .... Noteridae
[5 Nearctic genera, two species, *Hydrocanthus iricolor* Say 1823 and *Suphisellus puncticollis* Crotch 1873 in southeastern Canada (see Hilsenhoff 1992 for key and notes on ecology)]

1'. Metacoxal process smoothly continuous with metacoxal plate orseparated from metacoxal plate by metacoxal line anterior to insertion of hind leg; metasternum without a defined medial area forming a common ventral plate with metacoxal processes (Bidessonotus metasternum with median area defined by anteriorly converging lines but metacoxal process not elevated above metacoxal plate for its entire length); prosternal process with apex sharply to bluntly pointed . . . . .Dytiscidae, 2

2(1). Eye with anterior margin rounded on inner margin above base of antenna (Fig. 2A); male with protarsomeres 1 to 3 greatly widened to form a large, round or transversely oval palette (Fig. 2E); length moderate to very large, length = 8 to 40 mm [5 tribes, 8 genera, widespread] . . . . .Dytiscinae, p. 772

2'. Eye with anterior margin notched on inner margin above base of antenna (Fig. 2B); male with protarsomeres 1 to 3 not to moderately widened, not forming a round to transverse palette (Fig. 2F, G, H); length minute to large, length = 1 to 20 mm 3

3(2). Scutellum hidden by basal margin of pronotum in dorsal aspect (e.g., Fig.7), or if apex of scutellum minutely exposed, pro- and mesotarsi pseudotetramerous, tarsomeres 3 lobed apically and hiding small tarsomere 4 (Fig. 2G) 4

3'. Scutellum visible in dorsal aspect (e.g., Fig.3); pro- and mesotarsi various, most specimens distinctly pentamerous (Fig. 2F, H) 5

4(3). Prosternum and its process on same plane in lateral aspect (Fig. 2C); pro- and mesotarsi distinctly pentamerous, tarsomere 3 not bilobed and tarsomere 4 exposed (Fig. 2H); metatarsomeres with apical margin strongly lobed (Fig. 2J), metatarsal claws very unequal in length or only one claw present [2 genera, widespread] . . . . . Laccophilinae, p. 58

4'. Prosternum in lateral aspect declivous, i.e.; more or less flat anterior to procoxae then descendant between procoxae to prosternal process which is on a lower plane than midline of prosternum (Fig.2D); pro- and mesotarsi of most specimens pseudotetramerous, tarsomeres 3 lobed apically and hiding small tarsomere 4 (Fig. 2G); metatarsomeres not lobed apically (Fig. 2I), metatarsal claws subequal in length or dorsal claw much shorter and narrower than ventral claw [7 tribes, 27 genera, widespread] . . . . .Hydroporinae (except Methlini), p. 70

5(3). Elytron with apex produced as an acute spine (Fig. 13); prosternum in lateral aspect declivous, descendant between procoxae to prosternal process which is on a lower plane than midline of prosternum (Fig. 2D); pro- and mesotarsi with tarsomere 3 bilobed apically and partly hiding small tarsomere 4; [1 genus, widespread but eastern in Canada] . . . . .Hydroporinae (Methlini, *Celina*), p. 85

5'. Elytron apex right angled to acute but not produced as a spine; prosternum and its process on more or less same plane in lateral aspect; pro- and mesotarsi distinctly pentamerous; 6

6(5). Metacoxal lines strongly convergent and almost contacting medial line anterior to metacoxal lobes then diverging anteriorly (Fig. 3B); elytron of many specimens with narrow longitudinal striae (Fig. 3A); metatibia without group of setae on posteroapical angle [2 genera, widespread but eastern in Canada] .... Copelatinae, p. 44

6'. Metacoxal lines various but not strongly convergent anterior to metacoxal lobes (Fig. 1); elytron without longitudinal striae; metafemur with or without setae on posteroapical angle 7

7(6). Labial palpus very short, apical palpomere subquadrate (Fig.5B) [1genus, western] .... Hydrotrupinae, p. 52

7'. Labial palpus elongate, apical palpomere much longer than wide 8

8(7). Pronotum with lateral bead very narrow or indistinct; elytron with aciculate sculpture consisting of dense, isolated, short longitudinal lines (Fig. 6); male abdominal sternum 6 medially with a pair of sharply impressed longitudinal lines [1 genus, eastern] .... Agabetinae, p. 55

8'. Pronotum with lateral bead present or if absent, elytron without dense aciculate sculpture; sternum 6 various but without a pair of impressed longitudinal lines [4 tribes, 10 genera, widespread] ... Colymbetinae, p. 478

Subfamily Copelatinae Van den Branden, 1885

Figs. 3; 4

Diagnosis. Size small to moderate, length 1.8 to 10.0 mm. Shape elongate, ovate or elongate and subparallel, dorsoventrally depressed.

Color pale brown to piceous or rarely black; elytron unicolorous or variously maculate, many specimens with a paler band across base and/or an apical spot.

Sculpture consisting of fine isodiametric meshes with very fine to distinct punctation; strioles present on at least metacoxal plates and on many specimens also on pronotum, elytra and abdominal sterna.

Eye emarginate above base of antenna. Pronotum with lateral bead narrow but distinct on most specimens. Scutellum visible, not hidden by posterior margin of pronotum. Elytron of most specimens with longitudinal discal striae (Fig. 3A), number of striae and depth of their impression various (some exotic species with up to 11 discal striae, many species with fewer striae or striae lacking); many specimens with a short submarginal stria along posterolateral margin; serial punctures distinct and much larger than discal punctures in non-striate species, in striate species serial punctures situated in striae and less evident. Prosternum not declivous, in same plane as its process in lateral aspect; prosternal process ovate to bluntly pointed apically, contacting metasternum and narrowly separating mesocoxae. Metepisternum contacting mesocoxal cavity. Metacoxal process with rounded lobe covering base of trochanter; metacoxal lines (Fig. 3B) strongly convergent anterior to metacoxal processes and almost contiguous with medial line then diverging anteriorly, traceable to metasternum or not. Profemoral antennal cleaner weakly developed. Protibia dilated apically, its mesal margin sinuate or emarginate basally on some specimens (Fig. 4A). Hind legs slender; metafemur lacking setae on posteroapical angle; natatorial setae present along mesal margin of metatibia and both inner and outer margins of metatarsomeres 1 to 3 in both sexes; metatibial spurs acuminate apically. Pro- and mesotarsi pentamerous; metatarsus slender, tarsomeres not lobed apically, metatarsal claws short and subequal.

Male pro- and mesotarsomeres 1 to 3 narrowly to moderately dilated. Male genitalia with parameres symmetrical, apically with a digit-like process (Fig. 4B, E). Female ovipositor with elongate slender gonocoxae with fine ventral setae and apical spine-like process (Fig. 4D) (Burmeister 1990*b*, fig. 5*c*, 8).

Comments. Within North America this tribe is represented by the genera *Copelatus* Erichson and *Agaporomorphus* Zimmermann. Worldwide, the limits of the subfamily have varied somewhat but at present four genera, *Agaporomorphus*, *Aglymbus* Sharp, *Copelatus*, and *Lacconectus* Motschulsky, are assigned to Copelatinae (Ruhnau and Brancucci 1984). A key to these genera is provided by Guéorguiev (1968) and Pederzani (1995).

Members of Copelatinae were considered to be a tribe of Colymbetinae until relatively recently when Burmeister (1976) pointed out their unique features. The elevation of this group to subfamily level and its placement as the most primitive subfamily of Dytiscidae is confirmed by other studies (e.g., immature stages of *Copelatus*, De Marzo 1976; Ruhnau and Brancucci 1984; and Ruhnau 1986).

Key to genera of Copelatinae of North America

1. Length less than 3.0 mm; pronotum not or very feebly margined laterally; venter with basal abdominal sterna smooth and polished .... *Agaporomorphus* Zimmermann 1921
[1 Nearctic species, *A. dodgei* Young 1989, Florida]

1'. Length greater than 3.5 mm; pronotum distinctly margined laterally; venter with basal abdominal sterna with short curved strioles, widespread .... *Copelatus* Erichson

Genus *Copelatus* Erichson 1832
Figs. 3; 4

Copelatus Erichson 1832: 18, 38. Type species - *Dytiscus posticatus* Fabricius, by monotypy.

Diagnosis. Nearctic specimens small to medium size, length = 3.7 to 7.0 mm. Shape evenly elongate oval in dorsal aspect; distinctly flattened dorsoventrally.

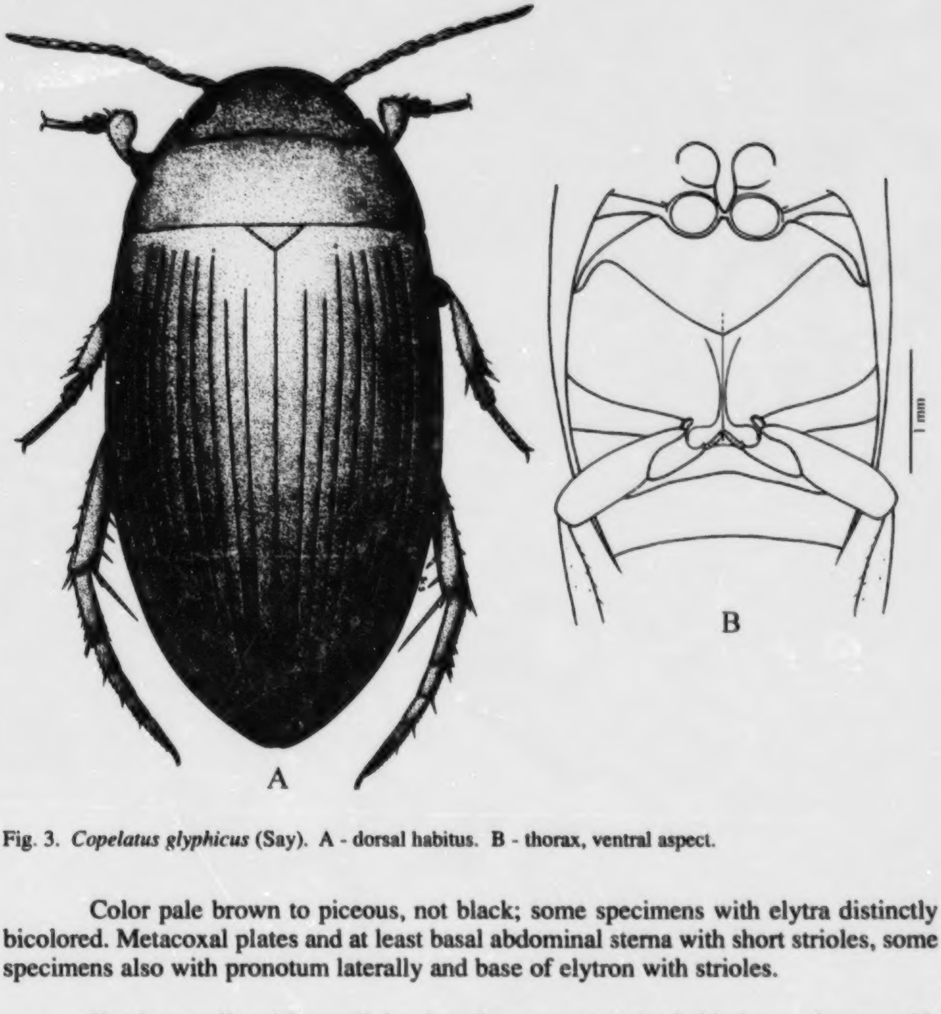


Fig. 3. *Copelatus glyphicus* (Say). A - dorsal habitus. B - thorax, ventral aspect.

Color pale brown to piceous, not black; some specimens with elytra distinctly bicolored. Metacoxal plates and at least basal abdominal sterna with short strioles, some specimens also with pronotum laterally and base of elytron with strioles.

Head ventrally with a well developed transverse carina behind eye; clypeus with anterolateral foveae transversely elongate but not contiguous medially; antenna and palpi normal, relatively elongate and slender. Pronotum with lateral bead present but narrow and not reaching apex of anterolateral angle of many specimens, disc mesad to bead swollen anteriorly, less so on basal quarter, sublaterally with a longitudinal depression or line of coarser punctures. Prosternum rounded to carinate medially, with anterior margin sinuate, medial convexity continuous onto prosternal process; prosternal process short, oval and bluntly pointed apically, finely margined laterally. Metasternum with anteromedial impression small, not extended posterad past level of middle of mesocoxae; metasternal wings very narrow and tongue-like. Metacoxa large; metacoxal lines arcuate, separated anteriorly but converging and narrowly separated anterad of metacoxal processes, diverging and turned outwards at almost right angles on metacoxal processes.

Male pro- and mesotarsomeres 1 to 3 moderately dilated, together bearing 15 oval, adhesive scales on ventral surface, distributed in four transverse rows of (from base) three, four, four, and four scales each. Parameres symmetrical, subequal in length to aedeagus, each with a large, subtriangular, sclerotized basal piece and a membranous apical lobe.

Female with pro- and mesotarsomeres slender, apical tarsomere slender and subequal in length to basal three tarsomeres. Ovipositor with gonocoxa elongate, cylindrical and lightly sclerotized, with at most short, sparse setae; apex rounded with a stout spine (Fig. 4D).

Comments. The immature stages of the subfamily Copelatinae (and *Hydrotrupes* Sharp) are unique among dytiscid larvae because they ingest their masticated prey. Prey consists primarily of copepods and ostracods but they are opportunistic and will probably consume anything they can overpower. Larvae of other groups of dytiscids use elongate, channelled mandibles to inject digestive saliva and then withdraw only the liquified portion of their prey.

The most recent catalogue of species of *Copelatus* records 365 species in the world fauna (Guéorguiev 1968). Most species occur in tropical and subtropical regions and only eight species occur in the Nearctic region, two of which are known from Canada. The Nearctic species were reviewed by Young (1963*a)*. These beetles are ready fliers, for within their range specimens are often collected at light and occur in temporary habitats, thus it is possible that some of the more northerly United States species may stray into Canada. Young (1963*a)* discussed the ecology of North American species. Most species occur in temporary pools.

Key to species of *Copelatus* of Canada and United States

(modified from Young 1963*a)*

1. Elytron with a posterolateral submarginal and 10 discal striae (Fig. 3A) 5

1'. Elytron with a posterolateral submarginal and 9 or fewer discal striae 2

2(1). Elytron with 8 or 9 discal striae; length 5.2 to 6.7 mm; broader; elytron more or less uniformly reddish brown or base diffusely paler on some specimens .... 1. *C. chevrolati* Aubé

2'. Elytron with 5 or 6 discal striae; length 3.7 to 5.3 mm; narrower; elytron with base distinctly paler yellow than rest of disc on most specimens 3

3(2). Elytron with 5 discal striae; length 3.7 to 4.7 mm; Florida to Texas 4

3'. Elytron with 6 discal striae; length 5.0 to 5.3 mm; southern Florida .... *C. cubaensis* Schaeffer 1908

4(3). Length 3.7 to 4.1 mm; form elongate, narrow, length: width = 2.05 to 2.30; southern Texas .... *C. debilis* Sharp 1882*a*

4'. Length 4.5 to 4.9 mm; form broader, length: width = 1.88 to 1.96; southern Florida .... *C. blatchleyi* Young 1953*e*

5(1). Length greater than 5.5 mm; pronotum with fine longitudinal strioles on sides of disc; Texas to Arizona and Mexico .... *C. distinctus* Aubé 1838*b*

5'. Length less than 5.5 mm, most specimens less than 5.0 mm; pronotum with longitudinal strioles or not; widespread 6

6(5). Pronotum with lateral bead ending at about level of base of anterolateral angle; pronotum with entire surface with short, fine longitudinal strioles; most specimens with base of elytron pale and contrasting with darker color of pronotum and remainder of elytron; metatarsomeres 1 to 4 ventrally with a well developed longitudinal groove; male protibia ventrobasally with a deep emargination; aedeagus in lateral aspect with apex produced as a beak-like process at right angles to base of shaft (Fig. 4H); New Jersey and Illinois to Florida and Texas ....*C. caelatipennis* Aubé 1838*b* [a polytypic species, United States specimens are assignable to *C. c. pinceps* Young 1963a, widespread, or *C. c. angustatus* Chevrolat 1863, southern Florida]

6'. Pronotum with lateral bead narrow but continuous to or almost to apex of anterolateral angle; pronotum lacking strioles or some females with a few short strioles laterally; dorsal surface more or less uniformly brown, elytron without a pale band across base; metatarsomeres 1 to 4 ventrally flat or with a very shallow, broad longitudinal impression; male protibia ventrobasally with a shallow emargination; aedeagus, in lateral aspect, elongate, slender and evenly arcuate 7

7(6). Elytron with intervals between striae conspicuously punctate; aedeagus apically with shaft sinuate but not strongly bent to right; New Jersey to Florida, and Michigan? ....*C. punctulatus* Aubé 1838*b*

7'. Elytron with intervals between striae inconspicuously punctate;aedeagus slender, apex abruptly curved to right (Fig. 4C); eastern Canada to Florida and Texas, also California and Oregon ....2. *C. glyphicus* (Say)

1. *Copelatus chevrolati* Aubé 1838

Fig. 4E – G

Copelatus chevrolati Aubé 1838*b*: 389. Type locality - United States.

Copelatus renovatus Guignot 1952: 170.

Selected References. Young 1963*a*: 74 – 75; Hilsenhoff 1993*b*: 125.

Description. Length = 5.3 to 6.7 mm; width = 2.6 to 3.1 mm; length: width = 1.98 to 2.14.

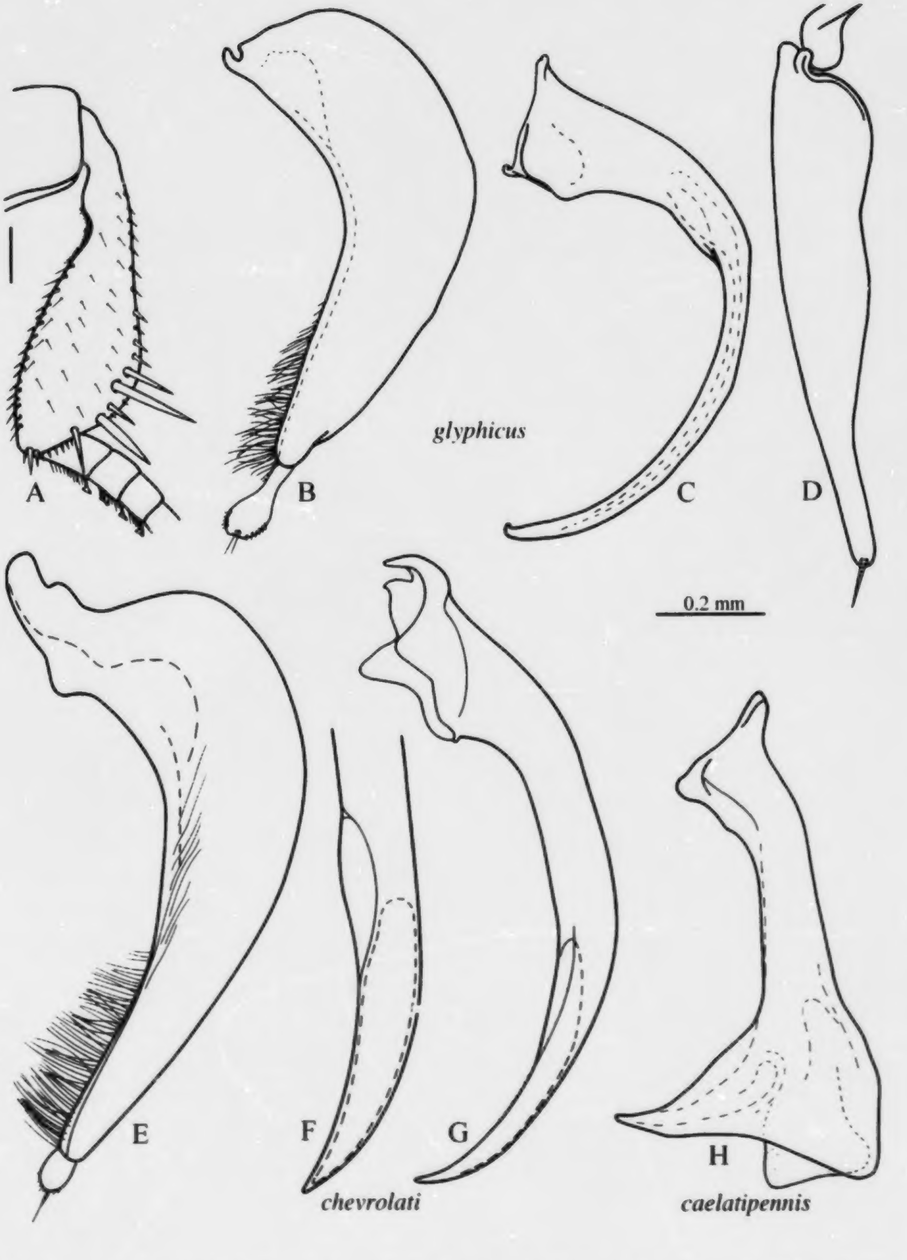

A
B
C
D
glyphicus
0.2 mm
E
F
G
H
chevrolati
caelatipennis

Fig. 4. *Copelatus*. A - D - *C. glyphicus*, A - male protibia, anterior aspect; B - paramere; C - aedeagus lateral aspect; D - gonocoxa. E - G - *C. chevrolati*, E - paramere, F - aedeagus dorsal aspect; G - aedeagus lateral aspect. H - *C. caelatipennis*, aedeagus lateral aspect.

Color various, dorsal surface ranging from more or less uniformly pale reddish brown to darker reddish brown or chestnut; metasternum, metacoxal plates and abdominal sterna of many specimens black.

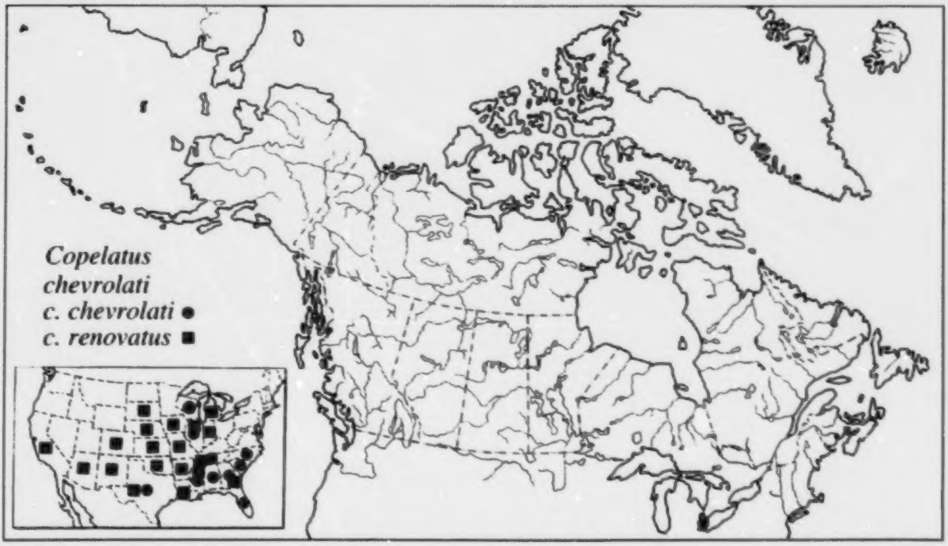
Body with fine, moderately dense punctation. Male pronotum with punctures only, lacking strioles; female pronotum with mediolateral portions of disc with variously developed, fine longitudinal strioles, these also present on base of elytron of some specimens.

Pronotum with lateral bead abbreviated and not extending onto anterolateral angle. Elytron with a short submarginal stria and 8 discal striae (a short 9th discal stria present subapically near suture on some specimens). Prosternal process strongly convex in cross section. Metatibia with a row of fine punctures along basal half of posteroventral margin; metatarsomeres not grooved ventrally.

Male protibia ventrobasally with a single shallow emargination. Aedeagus in lateral aspect evenly and shallowly arcuate in outline and evenly tapering toward apex, with a longitudinal ventral groove (Fig. 4F, G). Parameres without subapical emargination (Fig. 4E).

Ecology. Young (1954) stated that in Florida the species is characteristic of lentic sites where some organic debris has accumulated. Although it is a pioneer species, specimens also occur in permanent habitats (Young 1963*a)*. Michael and Matta (1977) recorded it from both temporary and permanent ponds. Ontario specimens were collected at light in early July.

Distribution. Map 1. Young (1963*a)* recognized two subspecies: *C. c. chevrolati* from the Atlantic and Gulf Coastal Plain area; and *C. c. renovatus* Guignot which ranges from Kansas to California and south into Mexico. The subspecies differ primarily in that a short subapical sutural stria is present on the elytron of specimens of the nominate subspecies but is absent from specimens of *C. c. renovatus*. The short subapical sutural stria may or may not be present on specimens from southern Ontario thus it is not



Map 1. *Copelatus chevrolati* **Aubé. Canadian and Alaskan collection localities and United States state records.**

possible to assign them to one of the subspecies. There are records of *C. c. chevrolati* from Michigan (Young 1963*a)* as well as specimens of *C. c. renovatus* from South Dakota and Wisconsin (Hilsenhoff 1993*b)*, so that both subspecies are known from close to the Canadian border.

2. *Copelatus glyphicus* (Say 1823)

Figs. 3; 4A – D

Colymbetes glyphicus Say 1823: 99. Type locality - Sullivan's Island, South Carolina.

Selected References. Young 1963*a*: 62; Alarie and Leclair 1988: 354; Hilsenhoff 1993*b*: 126.

Description. Length = 4.2 to 4.6 mm; width = 2.1 to 2.5 mm; length: width = 1.94 to 2.07. Habitus as in Fig. 3A.

Color pale yellowish brown to reddish brown with metasternum, metacoxal plates and abdominal sterna of many specimens darker brown to piceous.

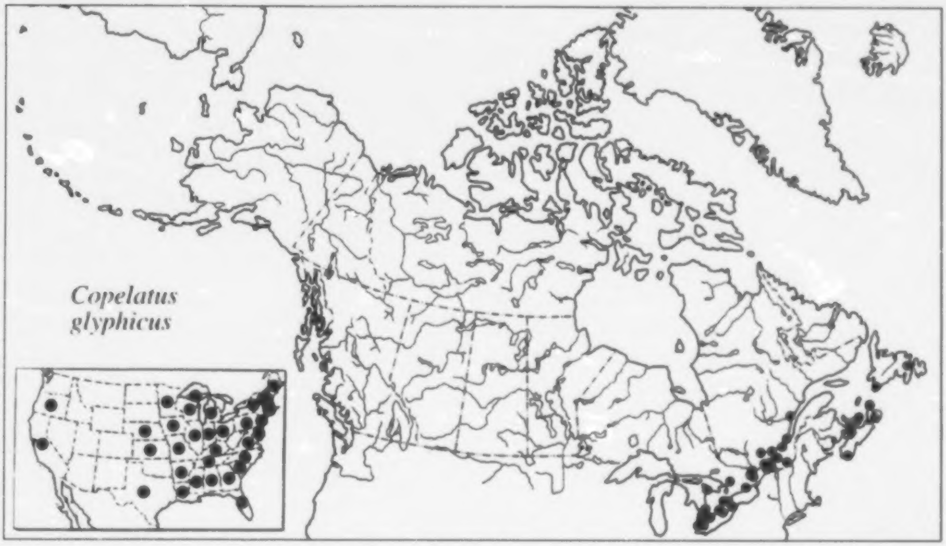
Body with fine, moderately dense punctation. Pronotum and elytra lacking longitudinal strioles.

Pronotum with lateral bead complete, reaching or almost reaching anterolateral angle. Elytron with a submarginal and 10 discal striae. Prosternal process relatively flattened, lowly and broadly convex basally. Metatibia with ventral face lacking punctures along posterior margin; metatarsomeres 1 to 4 flattened ventrally, not or only very shallowly and broadly longitudinally grooved.

Male protibia (Fig. 4A) ventrobasally with two shallow emarginations, although basal emargination may be hidden in specimens with tibia flexed against tibia. Aedeagus (Fig. 4C) in lateral aspect arcuate in outline, abruptly tapered beyond base then relatively parallel-sided to apex, apex in ventral aspect with a small, abrupt hook. Paramere with membrane-filled subapical emargination (Fig. 4B).

Ecology. Specimens were found to be abundant during early August in small, artificial pools such as gravel pit pools and tire ruts in peaty soils in Nova Scotia and New Brunswick. Many of these habitats were temporary and the presence of beetles may have been due to migration. In Newfoundland, specimens have been collected from slightly saline barachois ponds. Elsewhere, adult specimens have been collected from a variety of lentic habitats which includes both temporary and permanent ponds; the most common habitat being shallow water over a dense matt of decaying leaves. Teneral specimens have been collected 16 – 20 April (Texas), May (California and Tennessee), 10 – 18 August (Newfoundland and Nova Scotia), and from July to late September (majority in August) in southern Ontario. In southern Ontario, specimens were collected from light traps as early as June, but many of the teneral specimens seen from the province were collected in light traps later in the summer.

The mature larva and pupal stages were described by Spangler (1962).



Map 2. *Copelatus glyphicus* (Say). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 2. *Copelatus glyphicus* occurs throughout the eastern United States, and in California and Oregon. In Canada, it occurs from the Atlantic Provinces west to Ontario.

Subfamily Hydrotrupinae Roughley, new subfamily
Fig. 5

Type genus. *Hydrotrupes* Sharp 1882*a*, here designated.

Diagnosis. The single included species has a habitus (Fig. 5A) reminiscent of certain hydrophilid beetles, that is body broadly oval, lowly convex dorsally but almost flat ventrally; appendages short and broad.

Clypeus with anterolateral foveae not contiguous along anterior margin. Eye small, anterior emargination large and extending well into eye. Antenna short, medial antennomeres broad and subquadrate. Labial palpus (Fig. 5B) short, penultimate palpomere cup-shaped with several short and two long apical setae, terminal palpomere large, quadrate. Pronotum margined laterally, lateral bead broad, narrowest at posterolateral angle and increasing in width and convexity to front angle. Scutellum visible. Prosternum and its process in same plane in lateral aspect; prosternum medially with anterior margin angularly projecting forwards; prosternal process short but apex contacting metasternum, bluntly pointed apically, slightly convex in cross-section, strongly margined laterally with bead extending to apex. Metasternum with anteromedial lobe broadly but shallowly impressed for reception of prosternal process, impression not attaining level of hind margin of mesocoxae; metasternal wing narrow and strap-like laterally. Metacoxal process large, broadly rounded apically; metacoxal lines arcuate, well separated and diverging both anteriorly (slightly) and posteriorly. Pro- and mesotibiae broadened distally, outer margin bearing coarse spines. Metatrochanter very large, approximately two-thirds length of metatibia; metatibial comb small, with 2 to 4 setae arranged in an oblique series on posteroventral margin. Both sexes lacking natatorial setae on inner margin of metafemur and outer margin of metatarsus. Pro- and mesotarsi pentamerous. Metatarsal claws subequal in length.

Male genitalia with parameres symmetrical, consisting of a basal sclerite and a setose apical piece.

Comments. The systematic position of *Hydrotrupes* is uncertain. It has been placed within the subfamily Colymbetinae and associated with the tribe Agabini (Arnett 1963). However, characteristics of the larvae suggest that the relationship is not close and that it should be given separate subfamily rank.

Beutel (1994) conducted a preliminary examination of the phylogenetic position of *Hydrotrupes* based on features of the larval head. He placed *Hydrotrupes* as a basal member of Dytiscidae because it lacks many of the derived features of the family, suggesting it represents the sister group to Dytiscidae excluding Copelatinae. Of particular interest is the larval mandible of *Hydrotrupes* and Copelatinae which lacks the closed channel associated with preoral digestion in all other dytiscids. Larval members of both *Hydrotrupes* and Copelatinae chew their prey rather than ingesting only liquid material. This feeding difference is associated with a complex suite of structural characters of the anterior margin of the head and anterior portion of the digestive system.

Lack of a closed mandibular channel in *Hydrotrupes* and Copelatinae is probably a shared primitive character and not an indication of close relationship. These two groups differ in a number of other features. Instar 3 larvae of *Copelatus* have both

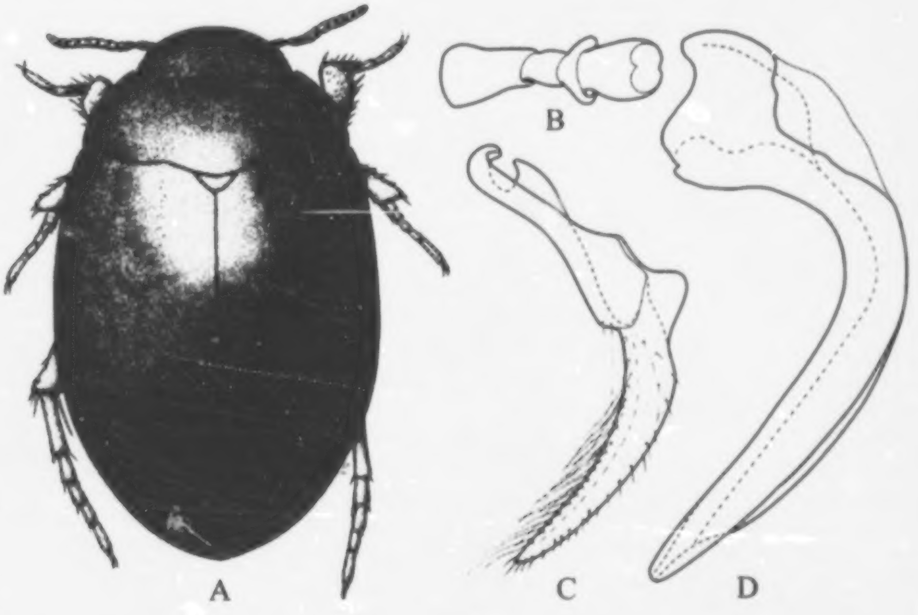


Fig. 5. *Hydrotrupes palpalis* Sharp. A - habitus. B - labial palpus, dorsal aspect. C - paramere. D - aedeagus, lateral aspect.

cutting edges of the mandible serrate (De Marzo 1976) whereas they are non-serrate in *Hydrotrupes*. Also, in mature larvae of *Copelatus* antennomere 3 has an elongate, sensory appendage (interpreted incorrectly by some authors as being biramous) whereas the equivalent structure of *Hydrotrupes* is quite small. Adults of *Hydrotrupes* have the apical palpomere of the labial palpus greatly enlarged and the metatrochanter is very large compared to the more normal forms of the same structures in adults of *Copelatus*. On the other hand, Alarie *et al*. (1998) studied a different suite of characters of *Hydrotrupes* larvae, the distribution of chaetae and pores, and concluded that *Hydrotrupes* is a colymbetine, closely related to *Agabus* and *Ilybius*. Clearly, the phylogenetic position of *Hydrotrupes* needs further study but in our opinion the combination of the features described above supports an isolated position, best indicated by subfamily ranking.

Genus *Hydrotrupes* Sharp 1882
Fig. 5

Hydrotrupes Sharp 1882*a*: 492. Type species - *H. palpalis* Sharp, by monotypy.

Diagnosis. With characteristics of subfamily.

Comments. This endemic North American genus contains a single species. However, there may be an additional undescribed species in California. A female specimen in CNC (Fresno, California) has smaller eyes and more regular sculpture than seen in other specimens.

Hydrotrupes palpalis **Sharp 1882**
Fig. 5

Hydrotrupes palpalis Sharp 1882*a*: 492. Type locality: California. Type - BMNH, not examined.

Description. Length = 4.0 to 4.7 mm; width = 2.3 to 2.7 mm; length: width = 1.68 to 1.79. Body broadly oval (Fig. 5A).

Body mainly piceous to black with anterior margin of head, lateral margins of pronotum and elytra and legs, reddish to piceous.

Elytron with sculpture consisting of fine lines forming large, irregularly shaped meshes of more or less similar size, intersections of lines each with a small puncture; many specimens (both males and females) with transverse segments of lines reduced, producing large longitudinally oriented meshes and lines with numerous punctures at points other than intersections; meshes smooth or faintly rugose at high magnification. Body glabrous except for usual fixed setae.

Metasternal wing of moderate width, width of metacoxal plate: width metasternal wing = 2.61 to 2.81.

Male pro- and mesotarsomeres 1 to 3 slightly dilated, each bearing a small number of small, oval scales on ventral surface; protarsal claws not modified. Male genitalia as in Fig. 5C, D.

Ecology. Several collectors have taken series of both adult and larval specimens at Seal Rock, Lincoln Co., Oregon. These insects are lotic and crawl around in thin films of water flowing over rocks on which there is a growth of filamentous algae. When disturbed, the beetles leap actively. This type of hygropetric habitat is rare amongst dytiscids.

Distribution. The species is restricted to the Pacific Coast of Oregon and California. There are no Canadian records.

Subfamily Agabetinae Van den Branden 1885

Fig. 6

Diagnosis. Length = 6.0 to 7.5 mm. Shape ovate, broadest in basal half of elytra, pronotum relatively short and transverse (Fig. 6A). Color more or less unicolorous, light to dark reddish brown. Sculpture consisting of very fine, elongate meshes, overlain by dense pattern of short aciculate grooves (Fig. 6A); discal punctation absent.

Eye emarginate above base of antenna. Pronotum with a fine line along lateral margin delimiting very narrow lateral bead. Scutellum visible. Elytron with serial punctures not distinguishable from discal punctures. Prosternum with anterior margin raised and projecting anteriorly, ventral surface medially convexly rounded; prosternum and prosternal process in same plane in lateral aspect, prosternal process narrow, triangular in cross-section, broadly margined laterally with bead inflated posterior to mesocoxae, acutely pointed apically with apex received into impression on anteromedial process of metasternum. Metepisternum contacting mesocoxal cavity. Metasternal wing moderately narrow laterally. Metacoxae with lines well separated, parallel or slightly diverging anteriorly, diverging posteriorly onto metacoxal lobes which cover bases of metatrochanters. Profemoral antennal cleaner weakly developed, composed of shallow notch on anterior margin with about 6 short hairs on ventroapical margin. Pro- and mesofemur with 6 to 8 very elongate, thin spines on ventral margin. Pro- and mesotarsus pentamerous. Metafemur robust, without a group of stout setae on posterovental angle; metatibia short and wide, metatibial spurs acute apically, shorter than metatarsomere 1; natatorial setae present along mesal margin of metatibia and both inner and outer margins of metatarsomeres in both sexes (metatarsomere 1 only of female); metatibial spurs acuminate apically. Metatarsus slender, tarsomeres not lobed apically, metatarsal claws subequal in length, short and curved.

Male sternum 6 with two medial, parallel grooves extending length of sternum and creating distinct medial ridge. Male pro- and mesotarsomeres 1 to 3 moderately dilated to form an elongate, palette. Male genitalia with parameres symmetrical, very narrow in apical half. Female ovipositor saw-like with numerous small teeth (Fig. 6E) (Burmeister 1990*a*, Fig. 6).

Comments. Members of Agabetinae were considered to be a tribe of Colymbetinae until recently (Burmeister 1990*a*). Many character states of the ovipositor of females demonstrate that this genus represents a separate subfamily which is the sister-group to Laccophilinae (Burmeister 1976, 1990*a*). However, the elevation of this group to subfamily level, its placement as one of the more primitive subfamilies of Dytiscidae and its placement as the sister group to the Laccophilinae require more detailed study (Nilsson 1989*c*). The subfamily as it is presently constituted contains only the genus *Agabetes*.

Genus *Agabetes* Crotch 1873
Fig. 6.

Agabetes Crotch 1873: 401. Type species - *Colymbetes acuductus* Harris, original designation.

Diagnosis. With characteristics of subfamily.

Comments. This genus contains two species with remarkably disjunct distributions. One species occurs in eastern North America whereas the second species, *A. svetlanae* Nilsson (1989), was described from Iran.

Agabetes acuductus (Harris 1828*b*)
Fig. 6.

Colymbetes acuductus Harris 1828*b*: 164. Type locality - Massachusetts. Type - MCZC, not examined.

Agabus rugulosus Aubé 1838*b*: 362 – 363. Type locality - "Amérique septentrionale" (synonymy after Guéorguiev 1968: 37).

Selected References. Young 1954: 103; Hilsenhoff 1992: 64.

Description. Length = 6.0 to 7.5 mm, width = 3.3 to 4.2 mm, length: width = 1.79 to 1.86. Body (Fig. 6A) broadly oval, lateral margins of pronotum and elytra meeting in a smooth curve in dorsal aspect; somewhat dorsoventrally depressed.

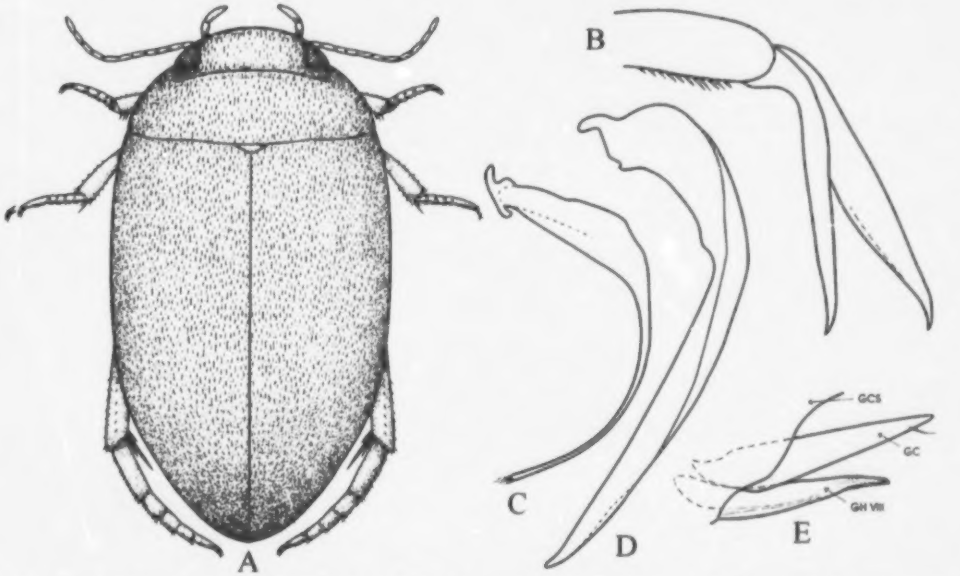


Fig. 6. *Agabetes acuductus* (Harris). A - habitus. B - male protarsal claws, posterior aspect. C - paramere. D - aedeagus. lateral aspect. E - female genitalia; GC - gonocoxa, GCS - gonocoxosternum, GH VIII - genital appendages, segment 8.

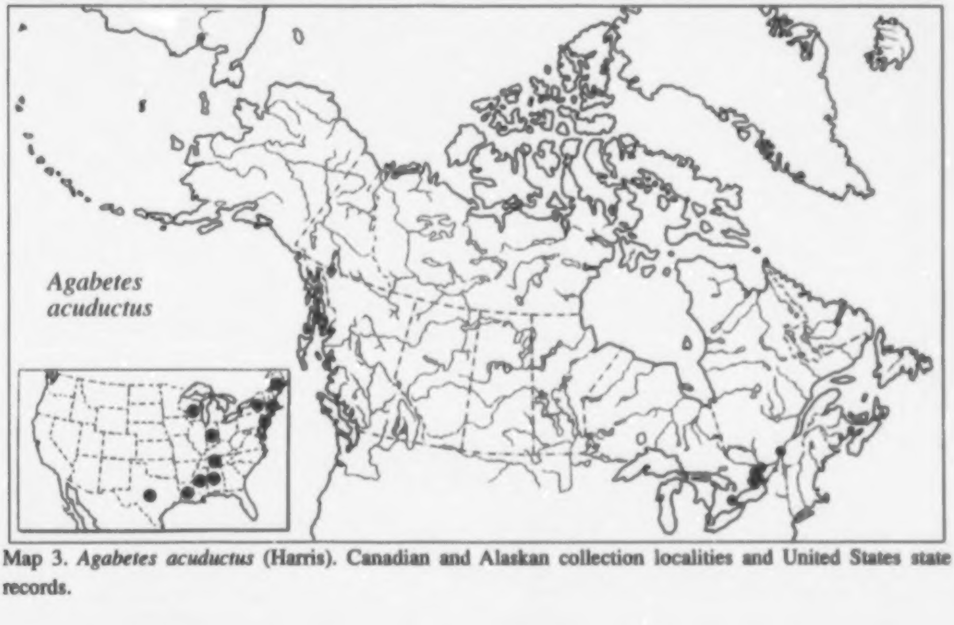
Body mainly reddish brown with head, lateral margins of pronotum and elytron laterally broadly rufous; legs rufous.

Sculpture of dorsum coarse, consisting of many short, elongate strioles or lines (Fig. 6A); strioles increasingly larger and denser from head to elytra; on elytra obscuring punctures; area between strioles finely reticulate, more coarsely so on female which is slightly duller.

Clypeus with anterolateral foveae not contiguous along anterior margin. Eye of average size. Antenna long and slender, medial antennomeres more than 3 times as long as wide. Labial palpus elongate, terminal palpomere conical. Pro- and mesotibia only slightly broadened distally. Metasternal wing moderately narrow, width metacoxal plate: width of metasternal wing = 3.47 to 4.07. Metatarsomeres 1 and 2 each with several dorsal setiferous punctures.

Male pro- and mesotarsomeres slightly dilated, pro and mesotarsomeres 1 to 3 together bearing 14 round, adhesive scales on ventral surface, distributed in four transverse rows of (from the base) two, four, four, and four scales each; pro- and mesotarsomere 5 elongate; protarsal claws (Fig. 6B) subequal, elongate with anterior claw foliate and posterior claw narrow; mesotarsal claws simple. Aedeagus in lateral aspect (Fig. 6D) bent at about right angle in basal third, apical two-thirds tapering apically, apex simple, dorsal channel deep and strongly twisted. Paramere (Fig. 6C) narrowed basally and continuing to apex as narrow strap, apex with apical tuft of setae. Ovipositor saw-like with numerous small teeth and with three basal projections (Fig. 6E) (see Burmeister 1990*a)*.

Ecology. This species occurs in deciduous forest areas of eastern North America. The most usual habitat is in shaded, deciduous woodland pools, where specimens occur amongst dense leaf litter (Young 1955*a)* or even in wet leaf packs above the water line. In southern Quebec, specimens have also been collected in *Typha* ponds. Adults have flight wings but flight muscles may not be functional in some specimens (Young 1954).



Map 3. *Agabetes acuductus* (Harris). Canadian and Alaskan collection localities and United States state records.

We have no flight records from Canada, however Spangler and Gordon (1973) recorded specimens at light in Maryland and we have seen specimens from Louisiana collected at black light, showing that members of some populations are capable of flight. Hilsenhoff (1987) collected most of his specimens in bottle traps.

The mature larva was described by Spangler and Gordon (1973).

Distribution. Map 3. This species ranges from southern Quebec and southern Ontario south to Florida and west to Wisconsin, Illinois and eastern Texas.

Subfamily Laccophilinae Bedel 1881

Figs. 7; 8

Diagnosis. Size very small to moderate, length = 1.9 to 7.0 mm (North American species to 6.5 mm). Shape ovate, broadest near base of elytra, lateral margin of pronotum and elytra continuous in dorsal aspect (Fig. 7A). Color yellow to black, elytra unicolorous or maculate. Sculpture various, absent, consisting of fine isodiametric, transverse or irregularly shaped meshes or in some species dual with larger meshes containing finer reticulation; with variously developed discal punctation; abdominal sterna usually with oblique grooves or strioles; surface glabrous except for usual setiferous punctures, elytron with or without a dense submarginal band of long setae posterad to middle.

Clypeal bead various, broadly broken medially to more or less complete. Eye emarginate above base of antenna. Pronotum without lateral bead. Scutellum concealed by pronotum in dorsal aspect. Prosternum and its process in same plane in lateral aspect; prosternal process strongly convex to carinate medially, acute apically and received into distinct V-shaped impression on metasternum. Mesocoxal cavity closed laterally between meso- and metasterna by mesepimeron, metepisternum not attaining coxal cavity. Metasternal wing narrow laterally, arcuate. Metacoxae with lines parallel or diverging anteriorly, diverging posteriorly onto metacoxal lobes which cover bases of metatrochanters; metacoxal lobes conjointly deltoid in shape, hind margin straight or slightly and broadly emarginate. Pro- and mesotarsus distinctly pentamerous, tarsomere 3 not bilobed. Hind legs broad, metatibia with posterior margin glabrous, lacking natatorial setae in both sexes; metatibial spurs sharply pointed or emarginate apically; metatarsomeres very broad, each with posteroapical angle strongly lobed (Fig. 2J), with dorsal and ventral setal fringes in both sexes; metatarsal claws unequal (non-North American taxa) or only a single claw present.

Male with pro- and mesotarsomeres 1 to 3 evidently dilated but not forming an oval plate; together bearing four transverse rows of stalked oval scales beneath. Male genitalia with parameres asymmetrical (Fig. 8B, C), right smaller and more strongly sclerotized than left; aedeagus at least twice as long as either paramere, asymmetrical in dorsal aspect. Female ovipositor strongly sclerotized, toothed ventrally (Fig. 7B).

Comments. This subfamily is represented in all zoogeographical regions of the world by the species-rich genus *Laccophilus*. The other ten genera of the subfamily are of more restricted distribution. Brancucci (1983) and Pederzani (1995) provided keys to the world genera of the subfamily.

Key to genera of Laccophilinae of North America

1. Metatibial spurs emarginate apically; size larger, length = 3.0 to 6.5 mm [widespread] . . . . *Laccophilus* Leach

1'. Metatibial spurs acute apically; size minute, length = 1.9 to 2.1 mm . . . . *Laccodytes* Regimbart 1895 [one North American species, *L. pumilio* (LeConte 1878*c*), Florida]

Genus *Laccophilus* Leach 1817

Figs. 7; 8

Laccophilus Leach 1817: 69. Type species - *Dytiscus minutus* Linnaeus, by monotypy.

Diagnosis. Small beetles, length = 3.0 to 6.5 mm. Body evenly oval with lateral margins of pronotum and elytra meeting in a smooth curve in dorsal aspect, point of maximum width generally in basal third of elytron; evidently dorsoventrally depressed. Color yellow or pale brown to piceous, elytra immaculate or variously patterned, in many specimens irrorate (small, dark freckle-like spots scattered on lighter ground color) or with irrorations coalesced into large maculations. Sculpture consisting of fine isodiametric or irregular shaped meshes, some species with variously developed larger meshes containing finer reticulation.

Pronotum with hind margin evidently lobed medially. Elytron with a sublateral row of densely set setae along apical half. Prosternal process slender, lanceolate. Metacoxae with lines subparallel anteriorly, divergent posteriorly onto coxal lobes. Metatibial spurs emarginate apically (emargination of longer claw may be very small on some species). Metatarsomere 5 with a single claw, that of male shorter and broader than claw of female.

Male specimens of some species with a stridulatory organ consisting of a fine file (series of fine transverse ridges) on metacoxal plate anterolaterad of leg insertion and a scrapper on opposing surface of metafemur. Rudimentary stridulatory organ also on females of some species.

Comments. Zimmerman (1970) revised the 27 North American members of the genus. Most species occur in the southern United States and only four species occur as far north as Canada although one of these, *L. biguttatus*, is boreal in distribution. Nearctic species are generally lentic but may also occur in quiet sections of warm, slow flowing streams. Some tropical species are lotic. Hilsenhoff (1992) provided a key to the larvae of the four species known from Canada.

Zimmerman (1960) studied habitat selection and seasonal population changes of four *Laccophilus* species in Illinois (three of which occur in Canada). Seasonal changes in adult populations indicate adult overwintering with larval stages developing during spring and summer. Although several species may co-occur in the same habitat, differences in habitat and seasonal periods of occurrence and development times exist which minimize interactions between species. Hilsenhoff (1992) in Wisconsin found some of these species to be univoltine whereas at least *L. m. maculosus* appeared to be bivoltine or to have staggered oviposition.

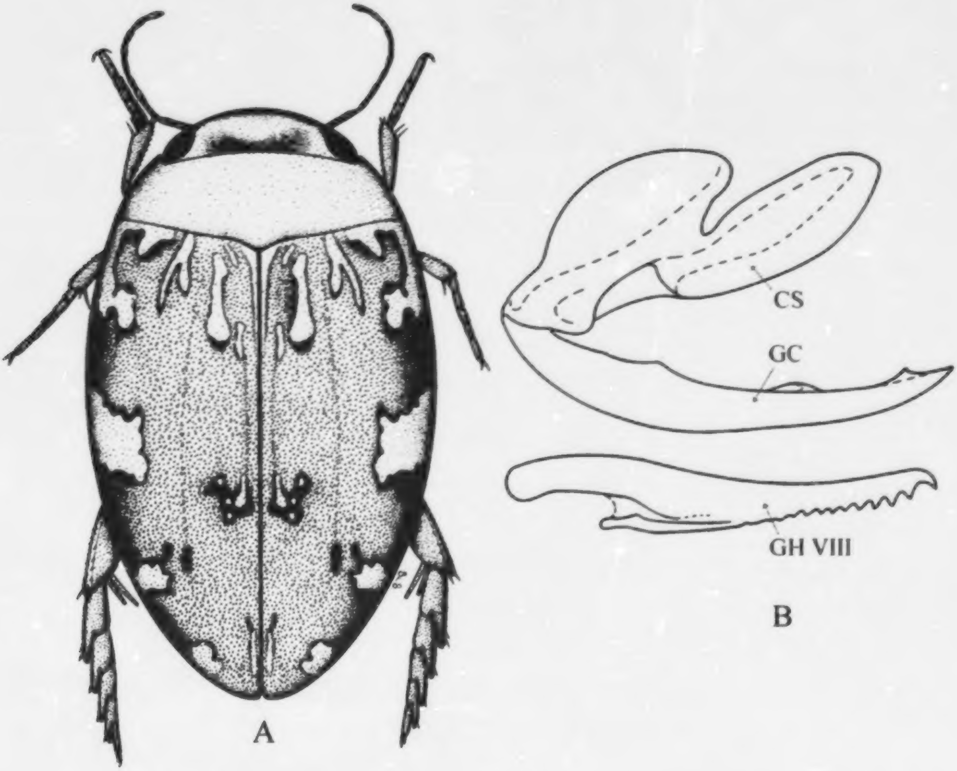


Fig. 7. *Laccophilus maculosus* Say. A - habitus. B - female genitalia; GC - gonocoxa, CS - gonocoxosternum, GH VIII - genital appendages, segment 8.

Species identification in *Laccophilus* may be difficult because some of the species are very similar to one another, differing mainly in details of the male genitalia. The following key includes all species known from Canada and the United States. Several of these species show distinctive geographical forms or subspecies and for their recognition refer to the detailed treatment by Zimmerman (1970). Important characters in species recognition are color pattern and the presence in the male of a stridulatory file. In some species, dark pigment of at least parts of the elytron is distributed as small freckles or spots (described by Zimmerman (1970) as "color applied as grains of sand") and is referred to as elytron being irrorate or with irrorations. The stridulatory organ consists of a series of closely spaced, fine ridges on the metacoxal plate anterior and lateral to the articulation point of the hind leg. The anterodorsal surface of the metafemur has a small sharp ridge that passes over this series of metacoxal ridges (Larson and Pritchard 1974) and presumably is capable of producing sound although observations of sound production have not been made.

Key to species of *Laccophilus* of Canada and the United States
(modified from Zimmerman 1970)

1. Elytron mainly black with contrasting yellow discal spots; southwestern United States, Texas and Kansas to Arizona. 2

1'. Elytron color various, unicolorous, irrorate or with darker vittae but not black with contrasting yellow markings; widespread 3

2(1). Metacoxal processes with conjoint hind margin emarginate medially, each process produced posterolaterally; male with metacoxal file; metacoxal plate entirely pale; epipleuron darkened in anterior half; length = 4.5 to 6.0 mm; Kansas and Texas to Arizona and Mexico . . . . *L. pictus* Laporte 1835

2'. Metacoxal processes conjointly with hind margin truncate; male lacking metacoxal file; metacoxal plate darkened at least along outer margin; epipleuron lightly infuscate at most; length = 4.2 to 4.8 mm; western Texas to southern Arizona, Mexico . . . . *L. horni* Van den Branden 1885

3(1). Male with a metacoxal file; elytron with irrorations 4

3'. Male without a metacoxal file; elytron color various but most specimens without irrorations 7

4(3). Metasternum and metacoxal plates black, abdomen rufous to piceous; Oregon and Idaho to Mexico; aedeagus as in Fig. 8M . . . . *L. mexicanus* Aubé 1838*b*

4'. Ventral surface of body yellow to brown 5

5(4). Elytron with an irregular transverse dark fascia on apical half; length = 4.3 to 5.2 mm; widely distributed in eastern United States . . . . 1. *L. fasciatus* Aubé

5'. Elytron without a distinct transverse fascia but irrorations may be locally denser laterally and along suture producing distinct spots; length 3.8 to 6.4 mm; widely distributed 6

6(5). Length = 4.7 to 6.4 mm; elytron with prominent pale spots along lateral, basal and sutural margins outlined by denser or confluent irrorations (Fig. 7A) . . . . 2. *L. maculosus* Say

6'. Smaller, length = 3.8 to 4.6 mm; elytron with irrorations of more or less even density, without or with only faint darker spots adjacent to palelateral areas of disc . . . . 3. *L. proximus* Say

7(3). Antenna and palpi distinctly infuscate apically; elytron uniformly brownish yellow to pale brown, without irroration or maculation; sculpture consisting of fine microreticulation with meshes small and rounded, of similar size and shape, punctures small and inconspicuous; length = 3.9 to 5.0 mm; distribution northern, Canada and northern United States, along Rocky Mountains to New Mexico . . . . 4. *L. biguttatus* Kirby

7'. Antenna and palpi entirely testaceous, or if somewhat darkened apically elytron with maculations or irrorations; elytral color and sculpture various; length various; distribution more southerly 8

8(7). Elytron mostly yellow with a postmedian blotch or variegated area from which four linear brown vittae or finger-like extensions extend anteriorly; pronotum anterior margin yellow; larger species, length = 4.9 to 7.7 mm; western, Kansas and Colorado south to Texas, California and Mexico 9

8'. Elytron without finger-like extension of pigment extending basally ondisc from a postmedian pigmented area; smaller, length = 3.2 to 5.3 mm 10

9(8). Elytron with basal longitudinal finger-like maculations of solid color; . . Kansas to Texas, California and Mexico . . . *L. quadrilineatus* Horn 1871

9'. Elytron with basal longitudinal finger-like maculations each darkly outlined and paler medially; southern New Mexico, Arizona, California and northwestern Mexico . . . .*L. sonorensis* Zimmerman 1970

10(8). Abdomen sternum 6 with lateral margin bearing an irregular row of short setae or spines; prosternal process long, metasternum with anteromedial impression extending posteriorly behind level of hind margin of mesocoxal cavities; length = 3.0 to 3.5 mm; Gulf Coast . . . .*L. gentilis* LeConte 1863

10'. Sternum 6 lacking row of spines on lateral margin; prosternal process short 11

11(10). Elytron with distinct irroration over most of elytral pattern; length =4.0 to 5.3 mm; Gulf Coast to Arizona (Young1953*c*) . . . .*L. vacaensis* Young 1953*c*

11'. Elytron without irrorations or with irrorations reduced and limited to edges of pattern; length various; widely distributed 12

12(11). Larger species, length = 4.0 to 4.8; Arizona . . .*L. oscillator* Sharp 1882*b*

12'. Length = 3.2 to 4.3 mm; east of Great Plains 13

13(12). Antenna and palpi entirely yellow, without apical infuscation; metacoxal plate with lateral margin darkened; Washington D. C. and Virginia . . . .*L. schwarzi* Fall 1917

13'. Antenna and maxillary palpus at least lightly infuscate apically; metacoxal plate with lateral margin not darkened; northeastern United States . . . . .5. *L. undatus* Aubé

1. *Laccophilus fasciatus* Aubé 1838

Fig. 8E, F

Laccophilus fasciatus Aubé 1838*b*: 423. Type locality - Cuitlahvac, Vera Cruz, Mexico (Zimmerman 1970).

Laccophilus rufus Melsheimer 1844: 28. Type locality - Pennsylvania.

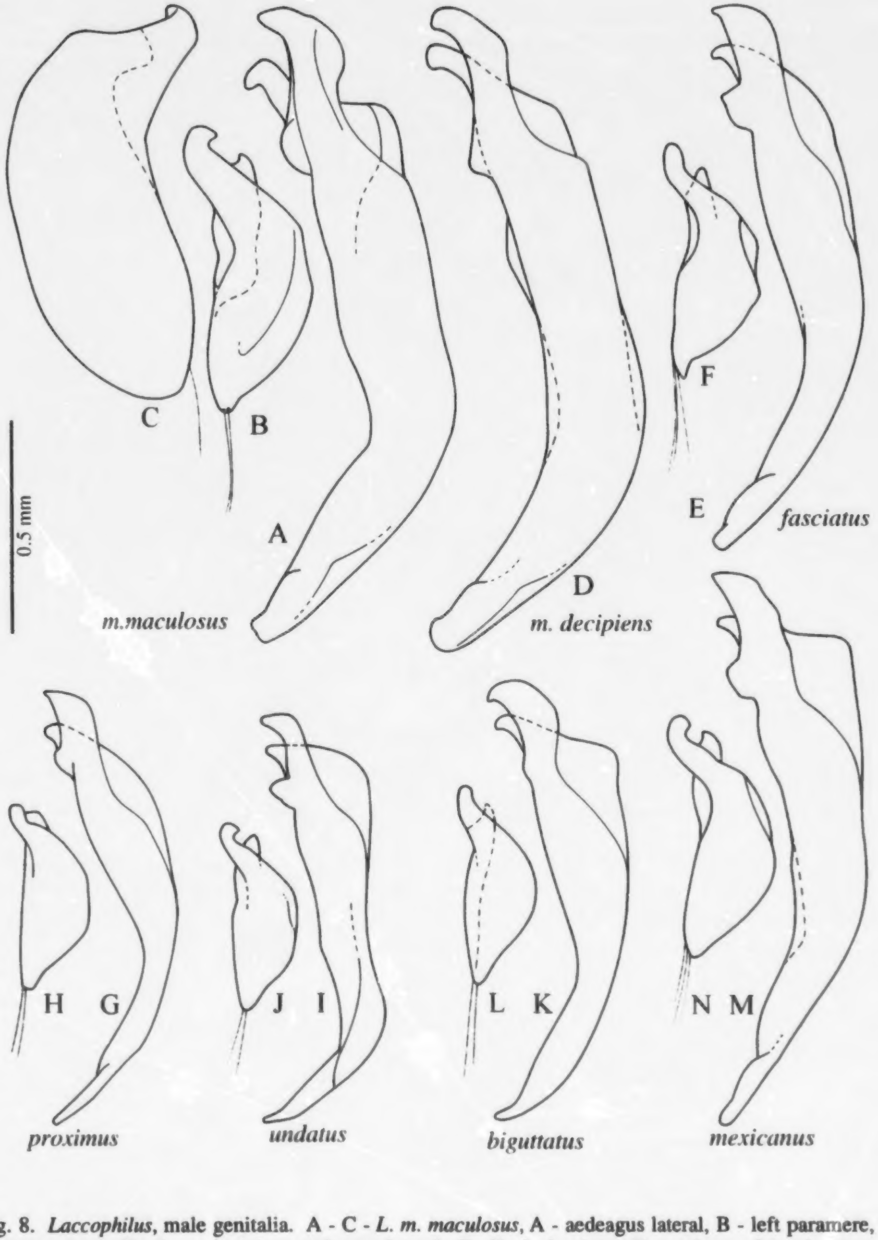

C
B
A
0.5 mm
m.maculosus
D
m. decipiens
F
E
fasciatus
H
G
J
I
L
K
N
M
proximus
undatus
biguttatus
mexicanus

Fig. 8. *Laccophilus*, male genitalia. A - C - *L. m. maculosus*, A - aedeagus lateral, B - left paramere, C - right paramere. D - *L. m. decipiens*, aedeagus lateral. E - F - *L. fasciatus*, E - aedeagus lateral aspect, F - left paramere. G - H - *L. proximus*, G - aedeagus lateral, H - left paramere. I - J - *L. undatus*, I - aedeagus lateral, J - left paramere. K - L - *L. biguttatus*, K - aedeagus lateral, L - left paramere. M - N - *L. mexicanus*, M - aedeagus lateral, N - left paramere.

Laccophilus terminalis Sharp 1882*a*: 292. Type locality - Davis Mountains, Jeff Davis Co., Texas (Zimmerman 1970).

Selected Reference. Zimmerman 1970: 63 – 91.

Description. Length = 4.3 to 5.2 mm; width = 2.3 to 2.8 mm; length: width = 1.74 to 1.82.

Head and pronotum yellow to reddish brown; antenna and palpi pale, without apical infuscation. Elytron with background color pale yellow to yellowish brown, with brown irrorations which on anterior half form a blotchy pattern with lobe-like basal and lateral extensions, behind middle irrorations darker and more or less confluent to form a broad transverse dark band; apex pale. Ventral surface yellow to reddish brown.

Elytral sculpture consisting of small, rounded meshes of somewhat irregular size basally but nearly isodiametric apically, with lightly impressed network of coarser meshes basally which become obsolete laterally and apically.

Antenna slender. Hind leg relatively broad, metatibia length: width = 2.2 to 2.3.

Male metacoxa with a file. Aedeagus in lateral aspect (Fig. 8E) with apex bluntly pointed or truncate but narrower than that of *L. maculosus*.

Comments. Zimmerman (1970) recognized three subspecies: *L. f. rufus* Melsheimer in eastern United States east of the Great Plains; *L. f. terminalis* Sharp in the Great Plains, southwestern United States and northern Mexico; and *L. f. fasciatus* Aubé in Mexico and Central America. The eastern North American *L. f. rufus* is likely to be found in Canada. Although Zimmerman (1970) reported a broad area of intergradation between *L. f. rufus* and *L. f. terminalis* in the southern Great Plains, we have seen a collection containing specimens of both *L. f. terminalis* Sharp and *L. f. rufus* from the same pond in northern Texas (Carson Co.), suggesting that the two forms may be specifically distinct.

Ecology. This species is most commonly found in exposed, muddy or silty bottomed temporary ponds. It is a pioneering species in newly formed aquatic habitats (Zimmerman 1970).

Distribution. This species has a wide distribution in Mexico and the United States except for the Rocky Mountains and the Pacific Northwest. Although there are no Canadian records, the species is common south of the Great Lakes and is likely to be found in southern Ontario.

2. *Laccophilus maculosus* Say 1823

Figs. 7; 8A – D

Laccophilus maculosus Say 1823: 100. Type locality - Bloomington, Monroe Co., Indiana (Zimmerman 1970).

Laccophilus decipiens LeConte 1852: 205. Type locality - Stanislaus Co., California (Zimmerman 1970).

Laccophilus shermani Leech 1944: 4 – 6. Type locality - Bear Canyon, Santa Catalina Mountains, Pima Co., Arizona.

Selected References. Zimmerman 1970: 29 – 63; Larson 1975: 259 – 260; Alarie and Leclair 1988: 355; Hilsenhoff 1992: 67.

Description. Length = 4.6 to 6.4 mm; width = 2.7 to 3.7 mm; length: width = 1.67 to 1.76. A large, broad species (Fig. 7A).

Body testaceous to pale brown; elytron testaceous, disc irrorate with brown spots which coalesce around irregularly shaped pale areas along basal, lateral and sutural margins. Antenna and palpi lacking apical infuscation.

Elytron sculpture dual with a network of irregular polygonal meshes superimposed on fine reticulation, lines of coarser meshes more lightly impressed or even obsolete apically.

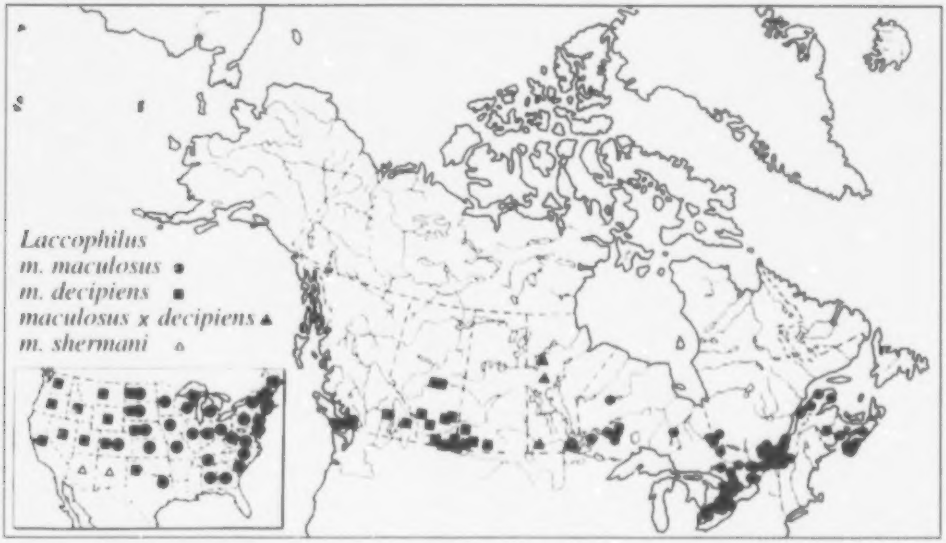
Antennomeres slender and elongate; apical antennomere sharply pointed. Hind legs broad, metatibia length: width = 2.1 to 2.2.

Male metacoxa with a well developed file. Aedeagus in lateral aspect (Fig. 8A, D) strongly bent near middle, apex broad.

Comments. Zimmerman (1970) recognized three subspecies, two of which occur in Canada. The nominate subspecies *L. m. maculosus* occurs east of the Great Plains whereas *L. m. decipiens* LeConte 1852 occurs from Saskatchewan to British Columbia. Specimens from Manitoba are intermediate. Specimens of *L. m. decipiens* differ from those of the nominate subspecies by being larger (5.1 to 6.4 mm versus 4.7 to 5.8 mm); the elytra are less darkly patterned and more evenly irrorate; and the apex of the aedeagus is slightly broader (Fig. 8A, D). The third subspecies, *L. m. shermani* Leech, occurs in Arizona, New Mexico and Texas and south into Mexico.

Ecology. This species occurs in both forested and grassland areas of southern Canada. The beetles occur in exposed, sun warmed shallows of permanent pools and ponds, generally amongst rooted vegetation but may also occur in sites with a continuous cover of *Lemna*. Hilsenhoff (1992) found bimodal peaks in numbers of adults and larvae over the summer and postulated the species is largely bivoltine in Wisconsin. Definite flight records have not been seen but many pinned specimens bearing lepidopterous scales have been observed in various collections, suggesting that they were collected in light traps.

Distribution. Map 4. This species occurs from coast to coast in southern Canada and throughout most of the United States and northern Mexico. Two of the three subspecies occur in Canada (see Comments above).



Map 4. *Laccophilus maculosus* Say. Canadian and Alaskan collection localities and United States state records.

3. *Laccophilus proximus* Say 1823
Fig. 8G, H

Laccophilus proximus Say 1823: 101. Type locality - Beaufort, South Carolina (Zimmerman 1970).

Selected References. Zimmerman 1970: 91 – 102; Hilsenhoff 1992: 67.

Description. Length = 3.6 to 4.6 mm; width = 2.1 to 2.5 mm; length: width = 1.73 to 1.87.

Head and pronotum reddish brown medially, paler laterally. Elytron brownish yellow with darker irrorations, irrorations not or only slightly coalescent along edges of pale areas of basal and lateral margins. Antenna and palpi not infuscate.

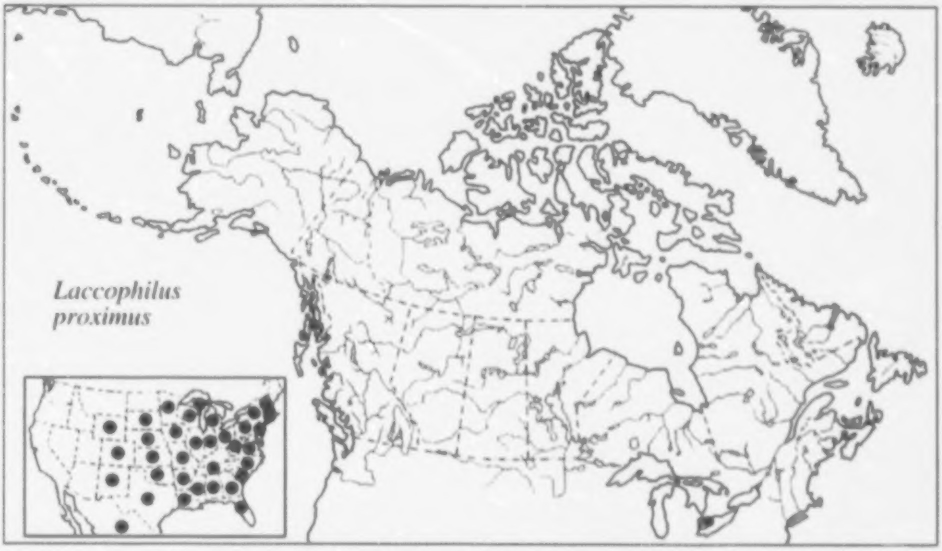
Elytron with small rounded meshes of more or less similar size, some specimens with a faint network of deeper lines forming larger, irregular meshes on basomedial portion of disk, becoming obsolete or absent apically.

Antenna slender. Hind leg relatively broad, metatibia length: width = 2.1 to 2.3.

Male metacoxa with file well developed. Aedeagus in lateral aspect (Fig. 8G) with apex straight and slender. Female with a small but evident metacoxal file.

Ecology. Young (1954) and Zimmerman (1960) regard this as a pioneer species, noting that it occurs commonly in temporary habitats and is the first *Laccophilus* species to appear in newly formed or rewatered ponds. Hilsenhoff (1992) found larvae only in open ponds and marshes and noted that larvae had broad seasonal occurrence indicating staggered oviposition.

Distribution. Map 5. The species occurs throughout most of the United States east of the Rocky Mountains. The Canada–United States border closely marks the northern limit of the range and the only Canadian records are two specimens collected in black light traps at Harrow, Ontario, and a specimen collected in a *Typha* marsh at Sudbury, Ontario (Paquette and Alarie 1999).



Map 5. *Laccophilus proximus* Say. Canadian and Alaskan collection localities and United States state records.

4. *Laccophilus biguttatus* Kirby 1837

Fig. 8K, L

Laccophilus biguttatus Kirby 1837: 69. Type locality – "Boreal America".

Laccophilus inconspicuus Fall 1917: 164. Type locality – Winnipeg, Manitoba.

Selected References. Zimmerman 1970: 193 – 199; Larson 1975: 260; Hilsenhoff 1992: 66; Roughley and Nilsson 1994: 91 – 101.

Description. Length = 3.9 to 5.0 mm; width = 2.3 to 2.6 mm; length: width = 1.71 to 1.90.

Color various, dorsal surface testaceous to pale brown with elytra darker than head and pronotum; elytron lacking irrorations; ventral surface testaceous to piceous. Antenna and palpi infuscate apically.

Elytron sculpture consisting of small, rounded meshes of similar size and shape, punctures small and inconspicuous.

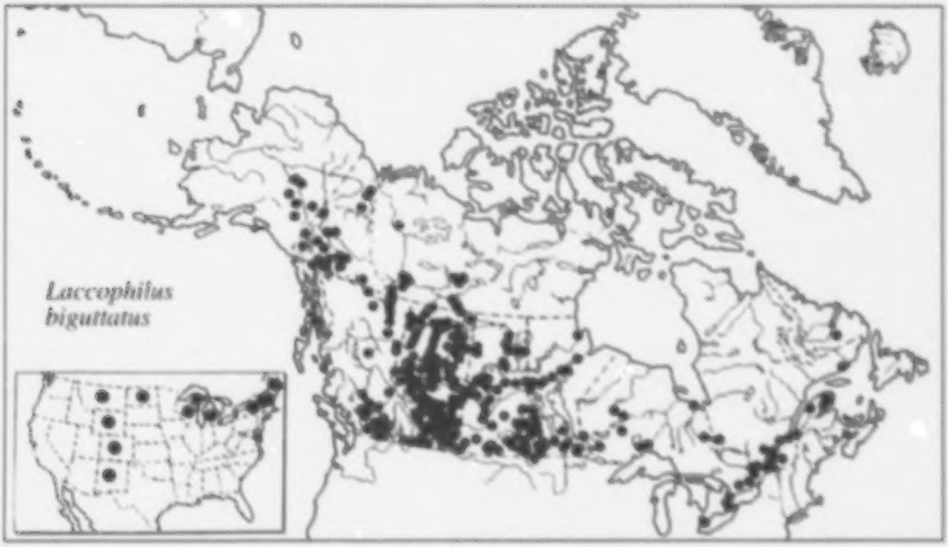
Antenna with antennomeres relatively short and stout. Hind legs relatively slender, metatibia length: width = 2.4 to 2.5.

Male metacoxa without a file. Sternum 6 more or less evenly rounded apically. Aedeagus and parameres as in Fig. 8K, L.

Comments. Larson (1975) noted that the color of the ventral sclerites of the body vary, from entirely pale to darkly infuscate and that within Alberta there was a habitat and geographical pattern to this variation. Color variation has been noted elsewhere in the range but has not been investigated so that its significance is not understood. Roughley and Nilsson (1994) have discussed variation in size and shape of the aedeagus over the species' Holarctic range.

Ecology. This species occurs in permanent ponds in both grasslands and forested areas. It does not occur in peatland pools but has been collected from the margins of sunwarmed, bog-margined lakes. Watts (1970), Barman (1972), Hagenlund and Nilsson (1985) and Hilsenhoff (1992) described immature stages and presented data on ecology. Larson (1975) and Hilsenhoff (1992) consider the species to be univoltine with larvae developing in midsummer. Larson (1975) recorded flight during the latter half of May in Alberta.

Distribution. Map 6. The North American range of this Holarctic species extends from Labrador and New Brunswick to Alaska and from the tree line south to the northern New England States and northern New Mexico.



Map 6. *Laccophilus biguttatus* Kirby. Canadian and Alaskan collection localities and United States state records.

5. *Laccophilus undatus* Aubé 1838

Fig. 8I, J

Laccophilus undatus Aubé 1838*b*: 435. Type locality - Bloomington, Monroe Co., Indiana (Zimmerman 1970).

Selected References. Zimmerman 1970: 208 – 211; Hilsenhoff 1992: 67 – 68.

Description. Length = 3.2 to 4.3 mm; width = 2.0 to 2.3 mm; length: width = 1.73 to 1.88. A relatively small species.

Head pale; antenna yellow basally, at least apical antennomere lightly infuscate apically; maxillary and labial palpi yellow, infuscate apically or not. Pronotum pale, yellow to reddish brown. Elytron with ground color brownish yellow, with a pattern of darker maculations generally forming several blotchy and undulating transverse lines. Ventral surface yellow to darker reddish brown.

Sculpture of elytron consisting of small meshes of irregular size and shape, with numerous distinct punctures subequal in diameter to meshes of reticulation.

Antennae slender. Hind legs moderately narrow, metatibia length: width = 2.3 to 2.4.

Male metacoxa without a file. Aedeagus in lateral aspect (Fig. 8I) abruptly bent subapically, apex sharply pointed.

Comments. Two other small species in eastern North America are similar to *L. undatus*. *Laccophilus schwarzi* Fall, known from Maryland and Virginia to Alabama (Folkerts and Donovan 1974), is similar but lacks infuscation of the antennae and palpi, elytra are yellow with two nearly complete transverse fasciae and ventral surface with margins of thoracic sclerites darkened. *Laccophilus gentilis* LeConte, which occurs along the southern range of *L. undatus* (Florida, Georgia and Louisiana), is similar to *L. undatus* but the antennae and palpi are not infuscate, length less than 4.0 mm, and prosternal process longer.

Ecology. Zimmerman (1970) considers this to be a species of shaded ponds in deciduous woodlands. He found it in temporary ponds, which is supported by Hilsenhoff's (1992) observation that the larvae develop earlier in the spring than those of other regional species. Folkerts and Donovan (1974) found it abundantly in temporary to semipermanent pools along stream margins and occasionally in nearby vegetated swamps.

Distribution. This species has a limited distribution in the northeastern United States. The range extends from Massachusetts to Washington, D.C., and west to Illinois and Wisconsin. On re-examination, specimens on which the Canadian record is based (Larson and Roughley 1991) proved to be *L. proximus*. Therefore there is no definite record of occurrence in Canada although this species is very likely in southern Ontario.

Subfamily Hydroporinae Erichson 1837
Figs. 9 – 122

Diagnosis. Size minute to moderate, length = 1.0 to 7.2 mm. Color, shape, sculpture and vestiture highly varied. Shape elongate and narrow to short and globose. Sculpture various, in most species consisting of fine meshes with distinct, often coarse, punctation.

Eye emarginate above base of antenna (Fig. 2B). Pronotum with lateral bead; hind margin with posteromedial lobe concealing scutellum in dorsal aspect (e.g. Fig. 10), except scutellum broadly exposed in *Celina* (Methlini) (Fig. 13) or its apex exposed in *Hydrocolus* (Hydroporini). Elytron with ventral surface with a sublateral longitudinal ridge on many specimens, ridge may be expanded to form a subapical ligula. Prosternum with base of process declivous in lateral aspect (Fig. 2D), process at its origin at prosternum sloping downward between procoxae (apparently upward toward viewer in ventral aspect), then apically bent parallel to longitudinal axis of body and in a more or less parallel but lower plane than midline of prosternum; in ventral aspect process narrowed between procoxae (neck region) then broadened into a blade which may or may not contact the metasternum apically; declivous portion of process may bear transverse ridges (prosternal file) and at its median bend have a variously developed ridge or tubercle (prominence). Mesocoxal cavity contacted by metepisternum (except Vatellini). Metacoxal processes of highly varied form, with or without lobes covering base of metatrochanter, hind margin adpressed to level of abdominal sternum or not; metacoxal lines not closely approximate medially, subparallel to diverging anteriorly. Pro- and mesotarsus of most specimens pseudotetramerous (Fig. 2G), tarsomere 4 small and more or less hidden by lobes of tarsomere 3 (tarsomere 4 clearly visible in *Celina* and *Bidessonotus*); hind legs generally slender, metatibia with natatorial setae along posterior margin in both sexes (absent in *Stygoporus*); metatibial spurs acuminate apically; metatarsus slender, tarsomeres not lobed apically (Fig. 2I), metatarsal claws similar in size and shape on most specimens.

Male pro- and mesotarsomeres 1 to 3 variously dilated, not evidently modified to strongly widened; ventral vestiture various, most specimens with two or more larger adhesive setae on ventral face of each tarsomere. Male genitalia with parameres symmetrical, simple or jointed (Bidessini), subequal in length to aedeagus. Female ovipositor with distinct valvifer absent except in Laccornini, gonocoxa with an elongate basal apodeme; gonocoxae not fused, rounded to pointed apically with few to many apical setae.

Comments. This is a large, heterogeneous grouping of minute to moderate sized dytiscids. The group is difficult to characterize on the basis of adult features, but the larvae are readily recognized by the nasale which is produced as a triangular lobe (sometimes laterally notched) above the mandibles. Wolfe (1985) listed 9 other synapomorphies for the Hydroporinae but admitted that most of these are inconclusive because they involve either loss or reduction of characters, or are parallelled in other groups of Dytiscidae. Basically, the subfamily is defined by: adults with proventriculus with one primary transversely oriented tooth on the sulcus, declivous prosternum, and absence of medial mandibular setae; and larvae with elongate nasale. The inclusion of Methlini within the subfamily greatly increases the subfamily heterogeneity. Its removal would leave the subfamily, as defined by Wolfe (1985), paraphyletic although some recent authors (Franciscolo 1979*a*, Pederzani 1995, Trémouilles 1995) have recognized Methlinae as a separate subfamily.

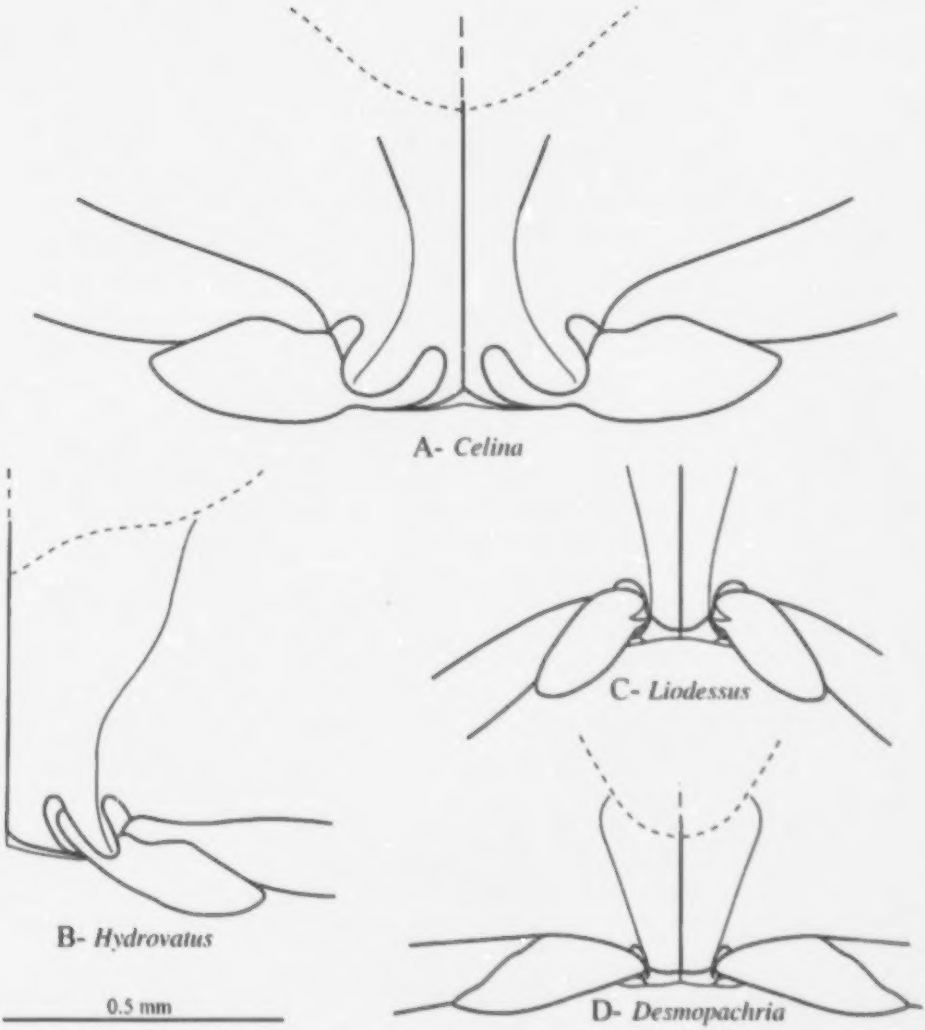


Fig. 9. Hydroporinae. Metacoxal processes, ventral aspect. A – *Celina*. B – *Hydrovatus*. C – *Liodessus*. D – *Desmopachria*.

Key to tribes of Hydroporinae of North America

1. Elytron and abdomen with apices acutely produced and spine-like (Figs. 13; 15); metacoxal process with hind margin deeply incised lateral to midline (Fig. 9A, B) 2

1'. Elytron and abdomen with apices not acutely produced, more or less rounded to angulate but not spine-like (lateral margin of elytron may be produced as a tooth near apex on some specimens); metacoxal process various but not deeply incised lateral to midline 3

2 (1). Scutellum visible; body elongate and subparallel, length: width 2.0 or more (Fig. 13); pro- and mesotarsi with tarsomere 4 broadly exposed . . . . .Methlini, p. 85

2'. Scutellum not visible; body short and broad, length: width less than 1.6(Fig. 15); pro- and mesotarsi with tarsomere 4 concealed within lobes of tarsomere 3 .... Hydrovatini, p. 91

3 (1). Metepisternum not reaching middle coxal cavity; prosternal processshort, apex ending in front of contiguous mesocoxae Vatellini .... Sharp
[one genus, *Derovatellus* Sharp 1882 *a*, one species, *D. lentus floridanus* Fall 1932, Florida]

3'. Metepisternum contacting lateral margin of middle coxal cavity; most specimens with prosternal process contacting metasternum medially and separating middle coxal cavities 4

4 (3). Male paramere jointed (Figs. 17D; 19B; 20C); pronotum with a sublateral plica on each side which contacts basal margin and extends anterad onto disc (Fig. 18); many specimens with a basal plica on elytron adjacent to pronotal plica; body shape various, broadly oval to elongate, length: width more than 1.50; size minute to small, length = 1.0 to 2.5 mm .... Bidessini, p. 100

4'. Male paramere not jointed, consisting of a single piece; pronotum without a sublateral plica which contacts basal margin, or if present, body subglobose, length: width less than 1.60; elytron without a basal plica; size various 5

5(4). Metacoxal process not lobed or produced laterally over base of trochanter (Fig. 9D); apex of metacoxal process adpressed to sternum 2 .... Hyphydrini, p. 95

5'. Metacoxal process with apicolateral angle extended over at least base of metatrochanter (Fig. 23); apex of metacoxal processes on distinctly lower plane than sternum 2, at least laterally 6

6(5). Anterior margin of hind leg with base of metafemur extending proximally to or almost to level of metacoxal lobe (Fig. 23A); length greater than 4.0 mm; prosternal process without a file .... Laccornini, p. 72

6'. Anterior margin of hind leg with base of metafemur separated (often only narrowly) from metacoxal lobes by metatrochanter (Fig. 23 B - I); length various; prosternal process with or without a file .... Hydroporini, p. 136

Tribe Laccornini Wolfe and Roughley
Figs. 10; 11; 12; 23A

Diagnosis. Hydroporines of relatively large size, length = 4.2 to 7.2 mm. Body elongate-oval with lateral margins of pronotum and elytra continuous in dorsal aspect (Fig. 10); body moderately to distinctly attenuate posteriorly, ventral surface somewhat flattened, dorsal surface evenly convex. Dorsal color rufous to dark brown or piceous, never black. Sculpture fine, consisting of small polygonal meshes on elytra; metacoxa and various sterna with oblique strioles on specimens of some species; dorsal surface generally glabrous.

Clypeus medially with a group of coarse setiferous punctures. Pronotum with complete, narrow lateral bead; pronotum with posteromedial lobe concealing scutellum. Elytron elongate, with lateral edge almost straight in lateral view, not or only slightly ascending to shoulder, epipleuron without humeral carina. Prosternum with lateral portions broadly inflated anterior to procoxae; declivity distinct; prominence distinct; file absent; prosternal process broadly convex medially, blade broad, short and rounded to truncate apically and received into broad impression on anteromedial process of metasternum. Metacoxal process apically lobed and covering base of metatrochanter; base of metafemur extending dorsally over metatrochanter and contacting or only very narrowly separated from metacoxal lobe (Fig. 23A). Metatarsal claws of equal length.

Male antenna with middle antennomeres slightly to distinctly modified. Protarsal claws slightly to highly modified. Male genitalia with parameres symmetrical, aedeagus subequal in length to parameres and variously modified, aedeagus with apex recurved. Female genitalia with distinct valvifer present, gonocoxa moderately sclerotized, not fused, rounded apically, lateral and apical margins with dense setae.

Comments. Wolfe (1985, 1989) and Wolfe and Roughley (1990) have discussed the phylogenetic position of *Laccornis*. It is the only genus of the tribe Laccornini and is the most primitive group of the subfamily Hydroporinae. This phylogenetic position has been confirmed through the study of larvae (Alarie 1989).

Genus *Laccornis* Gozis 1914
Figs. 10; 11; 12.

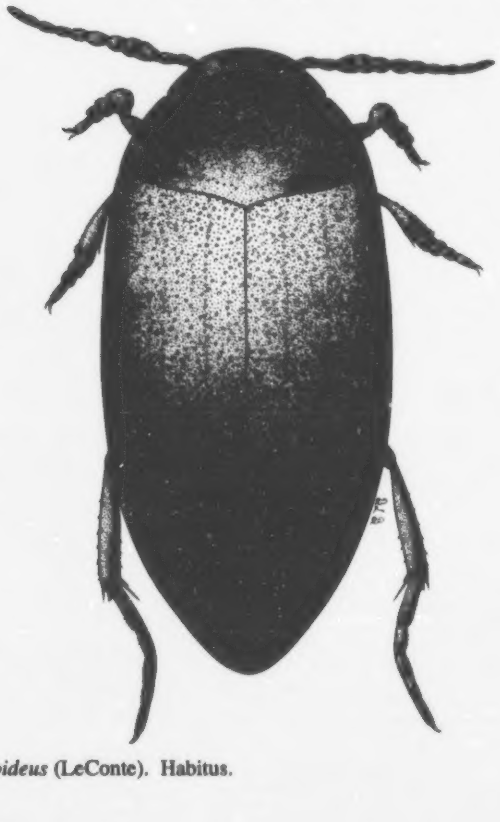


Fig. 10. *Laccornis conoideus* (LeConte). Habitus.

Laccornis Gozis 1914: 111. Type species - *Hydroporus oblongus* Stephens, by monotypy.

Diagnosis. With characteristics of tribe.

Sexual dimorphism occurs in shape of antennae and protarsus and its claws, and in some species also in vestiture of meso- and metafemora and shape of sternum 6. Male with at least some of antennomeres 3 to 7 slightly to distinctly broadened and with coarser sculpture beneath. Males of some species with elongate setae on hind margin of meso- and metafemora. Male pro- and mesotarsomeres 1 to 3 evidently dilated, together bearing four transverse rows of stalked elongate scales beneath; anterior protarsal claw variously modified. Male sternum 6 of most specimens longitudinally flattened medially.

Comments. The Holarctic genus *Laccornis* contains 10 species, of which nine occur in the Nearctic region. Most species occur in the deciduous forest areas of eastern North America but one is transcontinental boreal, one northern Cordilleran and the single Holarctic species occurs in the western arctic. Most species are associated with forests or shrubs and occur in small pools amongst accumulated leaves or mosses.

Key to species of *Laccornis* of North America

(after Wolfe and Roughley 1990)

1. Anterior protarsal claw modified and of different shape (Fig. 11A – D) from posterior claw; antennomere 4, at least, of most species enlarged and/or of different shape from subapical antennomeres (Fig. 11E, F); protarsomeres 1 to 3 ventrally each with enlarged scales; male specimens 2

1'. Anterior protarsal claw not modified, similar in shape to posterior claw;antennomere 4 not modified, similar in shape to subapical antennomeres; protarsomeres 1 to 3 ventrally with all scales of about same size; female specimens 10

2 (1). Outer antennomeres infuscate apically; metacoxal plate with punctures small but deep, dense and irregularly confluent medially making surface appear subrugose; length less than 5.1 mm 3

2'. Antenna without infuscation; metacoxal plate with punctation fine and separated; length greater than 5.1 mm 5

3 (2). Anterior protarsal claw without medial tooth (Fig. 11D); metafemurwithout elongate setae on posterior margin; western arctic . . . . 1. *L. oblongus* (Stephens)

3'. Anterior protarsal claw with medial tooth (Fig. 11A, B); metafemur with longate setae on posterior margin; boreal and Cordilleran 4

4 (3). Anterior protarsal claw with medial tooth shorter (Fig. 11A); aedeagus with reflexed apex broadened and spoon-shaped (Fig. 12B, C); length = 4.2 to 5.1mm; boreal species. . . . . .2. *L. conoideus* (LeConte)

4'. Anterior protarsal claw with medial tooth longer (Fig. 11B); aedeaguswith reflexed apex narrower than adjacent shaft and more or less parallel-sided (Fig. 12D, E); length = 4.5 to 4.9 mm; southwestern Alberta, southern British Columbia . . . . 3. *L. pacificus* Leech

5 (2). Metacoxa not striolate; protarsomere 5 with apex with anterolateral ridge; length greater than 6.2 mm 6

5'. Metacoxa striolate; protarsomere 5 with apex symmetrical; length less than 6.2 mm 7

6 (5). Length = 7.0 to 7.2 mm; aedeagus more expanded apically; western Tennessee and Alabama . . . . . . *L. nemorosus* Wolfe and Roughley 1990

6'. Length = 6.3 to 6.6 mm; aedeagus less expanded apically; Ontario, Michigan, Indiana, Illinois and Ohio . . . . 5. *L. deltoides* (Fall)

7 (5). Metafemur without elongate setae on posterior margin; antennomere 4 scarcely enlarged; aedeagus parallel-sided medially, apex reflexed (Fig. 12H, I); Appalachian and Great Lakes region . . . 4. *L. latens* (Fall)

7'. Metafemur with elongate setae on posterior margin; antennomere 4evidently enlarged; aedeagus broadly expanded medially, apex bent but not reflexed 8

8 (7). Anterior protarsal claw with apex or point medial and with lateral opening narrow and slit-like; length = 5.6 to 6.2 mm; Atlantic coastal plain, Massachusetts to South Carolina . . . . *L. difformis* (LeConte 1855)

8'. Anterior protarsal claw with apex or point displaced laterally and with lateral opening larger and notch-like; length = 5.2 to 6.0 mm 9

9 (8). Anterior protarsal claw with anterolateral process longer and lateral opening in form of inverted J; western Tennessee and Alabama to eastern Texas . . . . *L. schusteri* Wolfe and Spangler 1985

9'. Anterior protarsal claw with anterolateral process shorter and lateral opening in form of inverted U; Illinois and Pennsylvania to central Tennessee . . . . *L. etnieri* Wolfe and Spangler 1985

10 (1). Antenna with outer antennomeres infuscate apically; boreal, Cordilleran, arctic 11

10'. Antenna lacking infuscation; eastern North America 13

11 (10) Length: width greater than 2.13; most specimens with elytra not distinctly paler basally; western arctic . . . . 1. *L. oblongus* (Stephens)

11'. Length: width = 1.86 to 2.24; most specimens with elytra distinctly paler basally; distribution transcontinental including northwestern North America 12

12 (11). Transcontinental, boreal species . . . . 2. *L. conoideus* (LeConte)

12'. Cordilleran species, southwestern Alberta, southern British Columbia .... 3. *L. pacificus* Leech

13 (10). Metacoxa striolate 15

13'. Metacoxa not striolate 14

14 (13). Length = 6.2 to 6.6 mm; distribution more northern, Ontario, Michigan, Ohio, Illinois, Indiana .... 5. *L. deltoides* (Fall)

14'. Length = 7.0 to 7.2 mm; distribution more southern, Tennessee and Alabama .... *L. nemorosus* Wolfe and Roughley

15 (10). Prosternal process narrower .... 4. *L. latens* (Fall)

15'. Prosternal process broader 16

16 (15). Distribution along Atlantic coastal plain from Massachusetts to South Carolina .... *L. difformis* (LeConte 1855)

16'. Distribution west of Atlantic coastal plain 17

17 (16). Distribution, Alabama and extreme western Tennessee to eastern Texas .... *L. schusteri* Wolfe and Spangler 1985

17'. Distribution, Illinois and Pennsylvania to central and eastern Tennessee .... *L. etnieri* Wolfe and Spangler 1985

1. *Laccornis oblongus* (Stephens)

Figs. 11D; 12F, G

Hydroporus oblongus Stephens 1835: 437. Type locality - Cambridge, England.

Selected Reference. Wolfe and Roughley 1990: 309.

Description. Length = 4.3 to 4.7 mm; width = 2.0 to 2.2 mm; length: width = 2.15 to 2.18. Body narrow, widest at middle but somewhat parallel-sided and attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown. Head dorsally brown, reddish anteriorly and ventrally; antenna yellow basally with antennomeres 3 to 11 infuscate apically; palpi rufous, maxillary palpus infuscate apically. Pronotum dark brown, broadly reddish laterally. Elytron light brown, yellowish basally or not; epipleuron light brown. Ventral surface black except sterna 2 to 5 posteriorly and posterolaterally with areas of red. Legs reddish, femora indistinctly infuscate.

Head with small, relatively sparse punctures medially, punctures small and inconspicuous laterally and basally. Pronotal disc with sparse, fine punctures, punctures larger and denser toward margins. Elytron with punctation dual basally, larger punctures coarse and somewhat sparse basally but denser apically, micropunctures densest basally and laterally; epipleuron with small, sparse punctures. Metasternal wing laterally and metacoxal plate with dense, irregularly spaced moderate punctures, some of which are

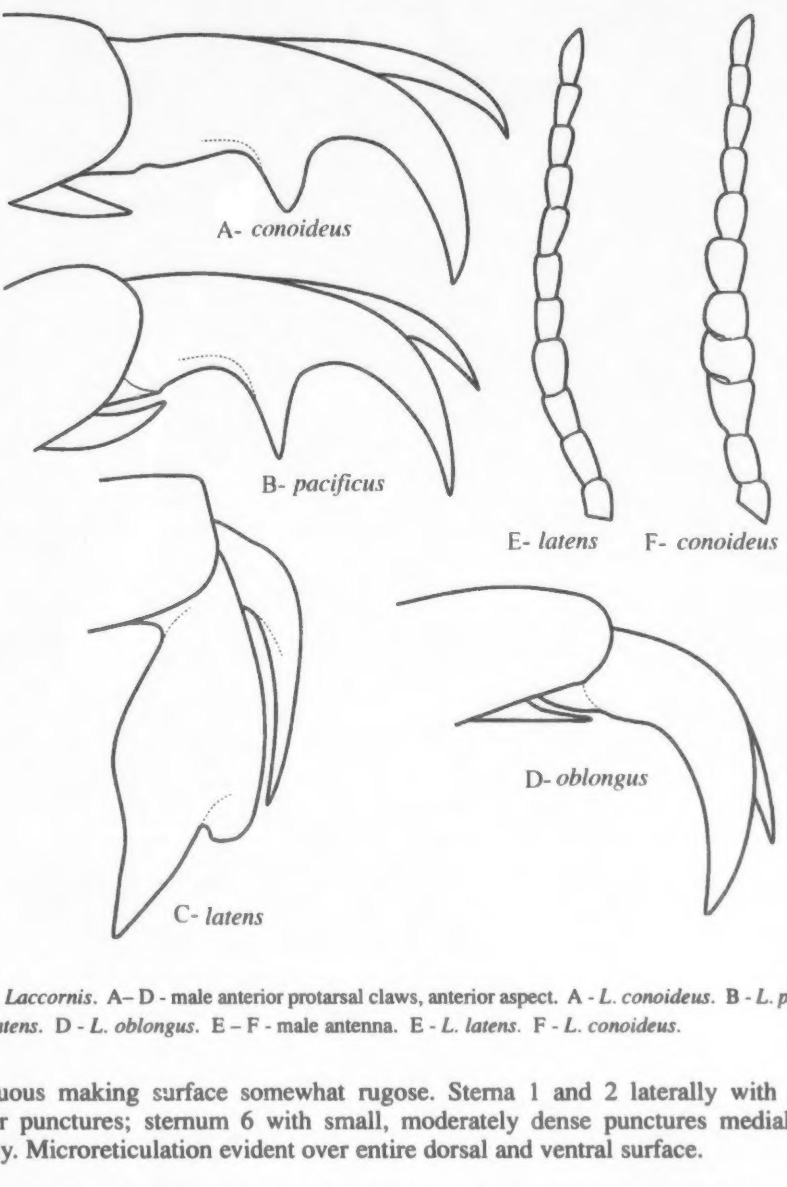


Fig. 11. *Laccornis*. A– D - male anterior protarsal claws, anterior aspect. A - *L. conoideus*. B - *L. pacificus*. C - *L. latens*. D - *L. oblongus*. E – F - male antenna. E - *L. latens*. F - *L. conoideus*.

contiguous making surface somewhat rugose. Sterna 1 and 2 laterally with sparse, smaller punctures; sternum 6 with small, moderately dense punctures medially and apically. Microreticulation evident over entire dorsal and ventral surface.

Pronotum with posterolateral angle obtuse; basal margin almost straight on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin straight, epipleuron visible almost to shoulder. Prosternum deeply excavate at base of process; process with declivity and prominence distinct; blade flat, very broad, without medial convexity, and broadly rounded apically.

Male antennomeres very slightly modified, 3 to 6 more or less flattened ventrally and with modified ventral sculpture, 4 to 6 slightly broadened. Male protibia width = 0.24 mm, ratio width of protarsomeres 1 to 3: width protibia = 0.68 : 0.74 : 0.60;

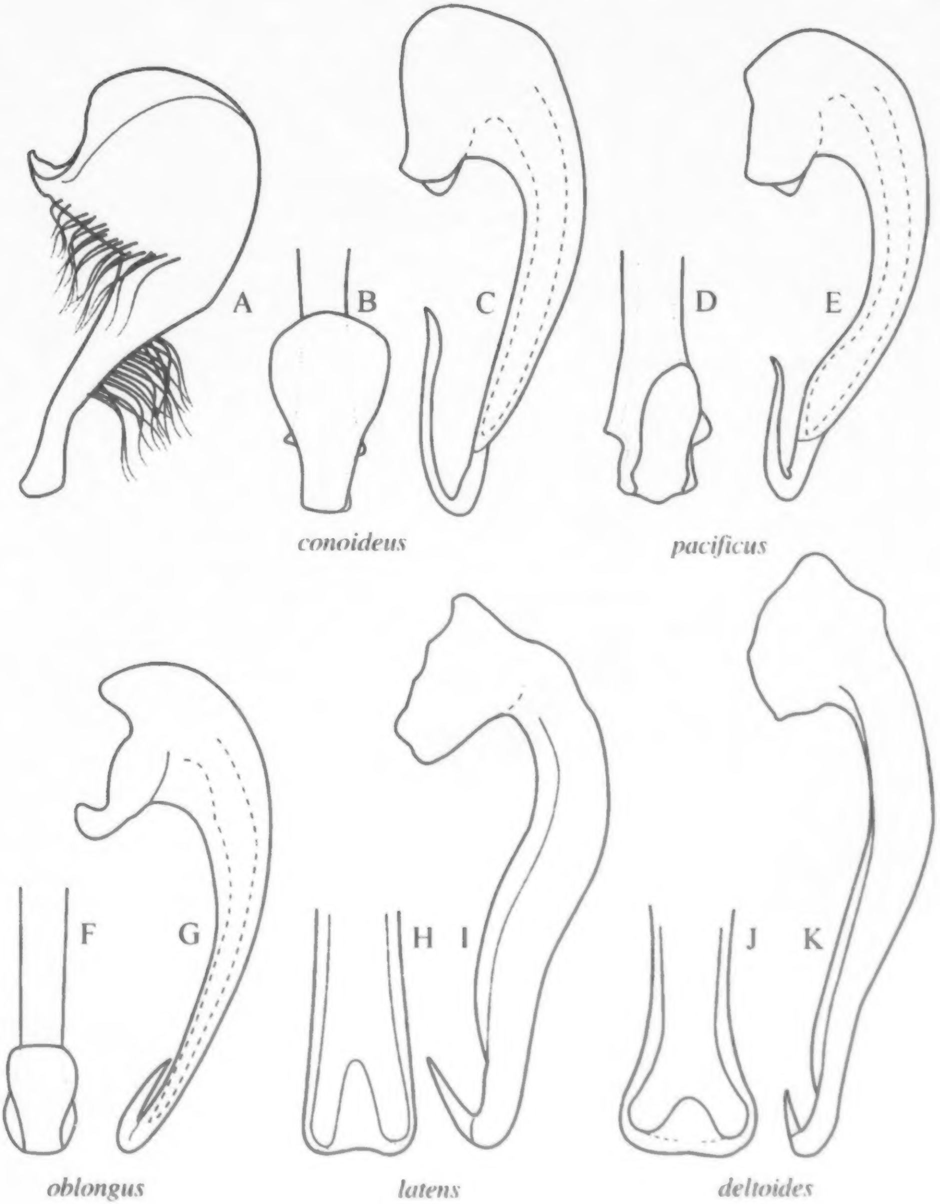
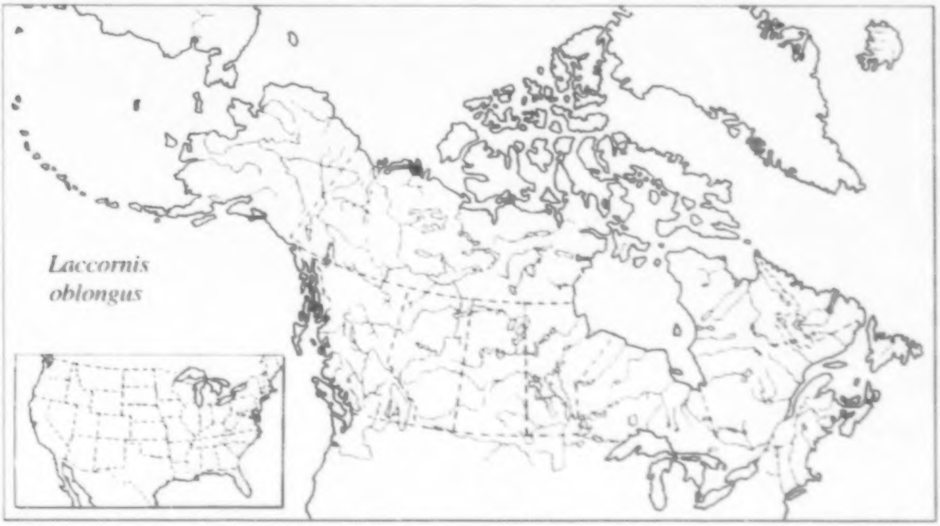

A
B
C
D
E
conoideus
pacificus
F
G
H
I
J
K
oblongus
latens
deltoides

Fig. 12. *Laccornis*. Male genitalia. A – C - *L. conoideus*, A - paramere lateral, B - aedeagus apex, ventral, C - aedeagus lateral. D – E - *L. pacificus*, D - aedeagus apex, ventral, E - aedeagus lateral. F – G - *L. oblongus*, F - aedeagus apex, ventral, G - aedeagus lateral. H – I - *L. latens*, H - aedeagus apex, ventral, I - aedeagus lateral. J – K - *L. deltoides*, J - aedeagus apex, ventral, K - aedeagus lateral.

protarsomere 5 symmetrical in dorsal aspect; anterior protarsal claw (Fig. 11D) longer and thicker than posterior claw, evenly narrowed apically and without a ventral tooth. Mesofemur with elongate setae on posterior margin, metafemur without elongate setae on posterior margin. Aedeagus (Fig. 12F, G) with setae on shaft and apex distinct, without subapical lateral tooth, reflexed apically with reflexed portion narrow and ligulate.

Ecology. In the Palaearctic this species is known to prefer acidic habitats with coarse organic debris. It occupies a variety of aquatic sites from permanent, mossy pools to ditches and snow-melt ponds. The life history and larval instars were described by Cuppen and Dettner (1987).

Distribution. Map 7. This species is Holarctic and is known from Great Britain and northern France across northern Europe and Siberia. The single North American record is from Tununuk, Northwest Territories.



Map 7. *Laccornis oblongus* (Stephens). Canadian and Alaskan collection localities and United States state records.

2. *Laccornis conoideus* (LeConte, 1850)

Figs. 10; 11A, F;12A – C

Hydroporus conoideus LeConte 1850: 216. Type locality - Eagle Harbour, Lake Superior.

Selected References. Larson 1975: 326; Wolfe and Roughley 1990: 312 – 313; Hilsenhoff 1994: 286.

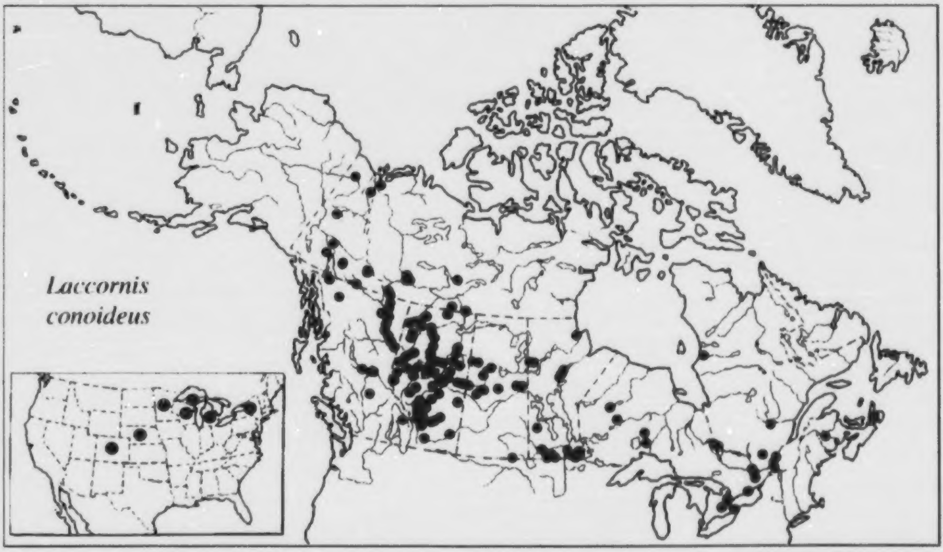
Description. Length = 4.2 to 5.1 mm; width = 2.1 to 2.5 mm; length: width = 1.86 to 2.09. Body narrow (Fig. 10), widest at middle but somewhat parallel-sided and attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown. Head dorsally brown, reddish anteriorly and ventrally; antenna yellow basally with antennomeres 3 to 11 infuscate apically; palpi rufous, maxillary palpus infuscate apically. Pronotum dark brown, broadly reddish laterally. Elytron light brown, yellowish basally or not; epipleuron light brown. Ventral surface black except sterna 2 to 5 posteriorly and posterolaterally with areas of red, some specimens with metasternum medially and most of abdominal sterna reddish. Legs reddish, femora lightly infuscate.

Head with small punctures medially, punctures smaller laterally and basally. Pronotal disc with punctation dual, consisting of sparse larger punctures and more numerous fine punctures, punctures larger and denser toward margins. Elytron with punctation dual, larger punctures coarse and somewhat sparse basally but denser apically, micropunctures densest basally and laterally; epipleuron distinctly punctate. Metasternal wing laterally and metacoxal plate with dense, irregularly spaced moderate punctures, some of which are contiguous making surface somewhat rugose. Sterna 1 and 2 laterally with sparse, smaller punctures; sternum 6 with small, moderately dense punctures. Microreticulation evident over entire dorsal and ventral surface.

Pronotum with posterolateral angle obtuse; basal margin almost straight on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin straight, epipleuron narrowly visible almost to shoulder. Prosternum deeply excavate at base of process; process with declivity and prominence distinct; blade flat, very broad, without medial convexity, and broadly rounded apically.

Male antennomeres 3 to 7 enlarged and with modified ventral sculpture, 3 and 4 broad, 5 to 7 gradually decreasing in width (Fig. 11F). Male protibia width = 0.23 mm, ratio width of protarsomeres 1 to 3: width protibia = 0.52 : 0.57 : 0.50; protarsomere 5 symmetrical in dorsal aspect; anterior protarsal claw (Fig. 11A) thicker than posterior claw, with a small, acute ventral tooth. Meso- and metafemora with elongate yellow setae on posterior margin. Aedeagus (Fig. 12B, C) with setae on shaft and apex distinct, shaft with a subapical lateral tooth on each side, reflexed apically with reflexed portion spatulate, at broadest wider than adjacent shaft.



Map 8. *Laccornis conoideus* (LeConte). Canadian and Alaskan collection localities and United States state records.

Ecology. *Laccornis conoideus* occupies a variety of habitats from vernal ponds and peatland ponds to pools in slow-moving streams but the preferred habitat is quite cold, shallow pools with mosses and emergent vegetation. J. Carr (*in lit.*) observed a pair in copulation 13 Aug. in Alberta. The mature larva was described by Watts (1970) and Alarie (1989).

Distribution. Map 8. In Canada, the range of this species extends from Newfoundland to the Yukon Territory. The species is parapatric with *L. pacificus* which replaces it in southwestern Alberta and southern British Columbia.

3. *Laccornis pacificus* Leech 1940

Figs. 11B; 12D, E

Laccornis pacificus Leech 1940: 123. Type locality - Salmon Arm, British Columbia.

Selected References. Larson 1975: 327; Wolfe and Roughley 1990: 313.

Description. Length = 4.5 to 4.9 mm; width = 2.1 to 2.4 mm; length: width = 2.09 to 2.24. Body relatively parallel sided, widest at humerus and attenuate posteriorly; lateral outline continuous in dorsal aspect. Very similar to *L. conoideus*, differing principally in coarser punctation, larger tooth of male protarsal claw and narrower reflexed apex of aedeagus.

Color reddish brown. Head dorsally brown, reddish anteriorly and ventrally; antenna yellow basally with antennomeres 3 to 11 infuscate apically; palpi rufous, maxillary palpus infuscate apically, and some specimens also with labial palpus lightly infuscate apically. Pronotum dark brown, broadly reddish laterally. Elytron light brown, yellowish basally or not; epipleuron light brown. Ventral surface rufopiceous to black except sterna 2 to 5 posteriorly and posterolaterally reddish. Legs reddish, femora lightly infuscate.

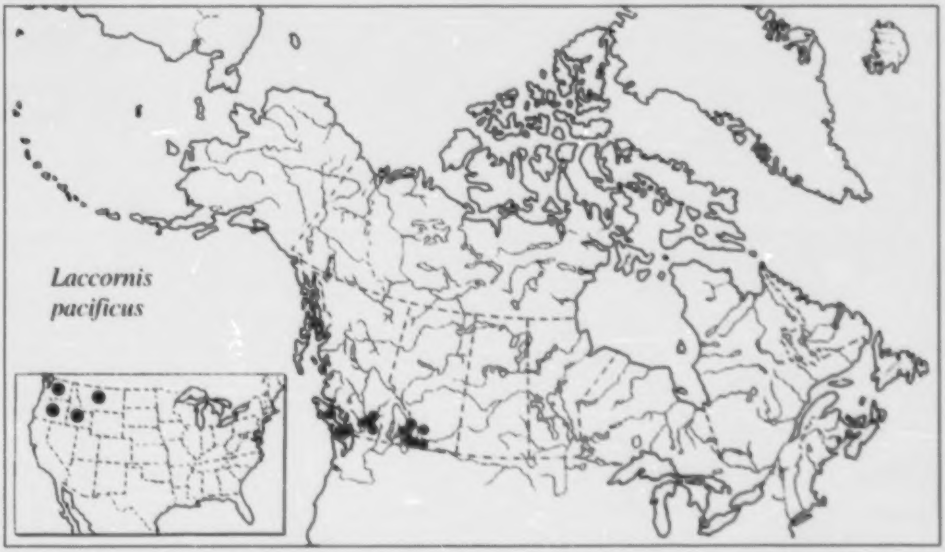
Head with punctures larger and denser than in *L. conoideus*, on many specimens punctures close or even confluent medially on frons, punctures smaller and sparser laterally and basally. Pronotal disc with punctation more or less dual, consisting of sparse slightly larger punctures and more numerous fine punctures, punctures larger and denser toward margins. Elytron with punctation very strongly dual, larger umbilicate punctures coarse and somewhat sparse basally but denser apically, micropunctures densest basally and laterally; epipleuron distinctly punctate. Metasternal wing laterally and metacoxal plate with dense, irregularly spaced moderate punctures, some of which are contiguous making surface somewhat rugose. Sterna 1 and 2 laterally with sparse, smaller punctures; sternum 6 with very small punctures. Microreticulation evident over entire dorsal and ventral surface.

Pronotum with posterolateral angle obtuse; basal margin almost straight on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin straight, epipleuron narrowly visible almost to shoulder. Prosternum deeply excavate at base of process; process with declivity and prominence distinct; blade flat, very broad, without medial convexity, and broadly rounded apically.

Male antennomeres 3 to 7 enlarged and with modified ventral sculpture, 3 and 4 broad, 5 to 7 gradually decreasing in width. Male protibia width = 0.23 mm, ratio width of protarsomeres 1 to 3: width protibia = 0.55 : 0.61: 0.53; protarsomere 5 symmetrical in dorsal aspect; anterior protarsal claw (Fig. 11B) thicker than posterior claw, with an acute ventral tooth, larger than that of *L. conoideus*. Meso- and metafemora with elongate yellow setae on posterior margin. Aedeagus (Fig. 12D, E) with setae on shaft and apex distinct, shaft with a subapical lateral tooth on each side, reflexed apically with reflexed portion only slightly broadened subapically, at broadest narrower than adjacent shaft.

Ecology. The habitat is similar to that of *L. conoideus*, although Leech (1940) added occurrence in a cold spring. Several collections have been made from small pools under willow and alder bushes in stream valleys. It occurs from sea level in the Gulf Islands to elevations up to 1310 m (= 4,300 ft.) in the Rocky Mountains.

Distribution. Map 9. This species occurs in the northwestern United States, north to southwestern Alberta and southern British Columbia.



Map 9. *Laccornis pacificus* Leech. Canadian and Alaskan collection localities and United States state records.

4. *Laccornis latens* (Fall 1937)

Figs. 11C, E; 12H, I

Laccornis latens Fall 1937: 10. Type locality - Sherborn, Massachusetts.

Selected References. Wolfe and Roughley 1990: 315; Hilsenhoff 1994: 287.

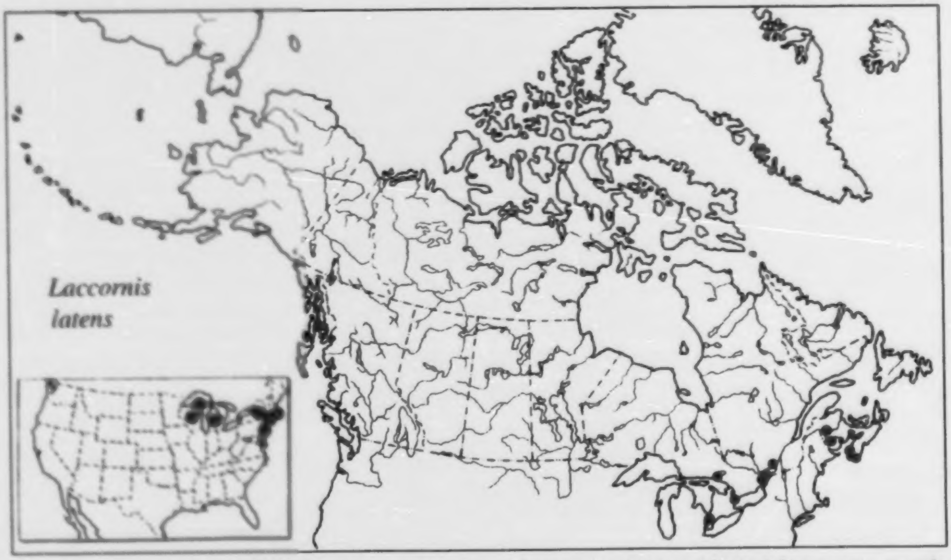
Description. Length = 5.2 to 5.6 mm; width = 2.5 to 2.6 mm; length: width = 2.13 to 2.14. Body ovate, widest near base of elytra and more or less smoothly attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown. Head mainly reddish, infuscate posterolaterally; antenna and palpi yellow; without infuscation. Pronotum piceous, broadly reddish laterally. Elytron dark brown with base broadly yellowish; epipleuron light brown, on some specimens partly infuscate. Ventral surface black. Legs reddish.

Head with punctures small and moderately dense, sparser posteriorly. Pronotal disc with punctation dual, punctures much larger and denser towards margins. Elytron with punctation dual basally with coarse and moderately dense larger punctures and micropunctures, micropunctures very sparse on apical half; epipleuron with coarse, sparse punctures. Metasternal wing laterally with coarse, dense punctures; metacoxal plate and sterna 1 to 5 laterally with punctures obscured by longitudinal to oblique strioles; sternum 6 basally with short strioles, apically with fine, sparse punctures. Microreticulation evident over entire dorsal and ventral surface.

Pronotum with posterolateral angle about right angled; basal margin slightly sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron visible almost to shoulder. Prosternum excavate at base of process; process with declivity distinct, and prominence low and rounded; blade broad with medial convexity low and rounded but distinct, rounded apically.

Male antennomere 4 slightly enlarged, slightly flattened and with reticulate ventral sculpture, other antennomeres not modified (Fig. 11E). Male protibia width = 0.26 mm, ratio width of protarsomeres 1 to 3: width protibia = 0.52 : 0.57 : 0.67; protarsomere 5 symmetrical in dorsal aspect; anterior protarsal claw (Fig. 11C) distinctly contorted, without a ventral tooth. Meso- and metafemur without elongate setae on posterior margin. Aedeagus (Fig. 12H, I) without setae on shaft, shaft not toothed laterally, reflexed apex narrow and triangular.



Map 10. *Laccornis latens* (Fall). Canadian and Alaskan collection localities and United States state records.

Ecology. The most common habitat for this species is semi-permanent, cool, shaded pools with deep leaf debris but few vascular plants; moss is often abundant. Hilsenhoff (1994) also noted an association with *Sphagnum*. Larvae were described by Alarie (1989).

Distribution. Map 10. Specimens are known from New Brunswick to Ontario and Wisconsin and south to New Jersey and Michigan.

5. *Laccornis deltoides* (Fall, 1923)

Fig. 12J, K

Agaporus deltoides Fall 1923: 123. Type locality - Beaver Creek, Illinois.

Selected References. Wolfe and Roughley 1990: 316 – 317; Hilsenhoff 1994: 287.

Description. Length = 6.2 to 6.6 mm; width = 3.2 to 3.5 mm; length: width = 1.91 to 1.94. Body fusiform, widest well before middle and distinctly tapering posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown. Head dorsally and ventrally rather uniformly reddish. Antenna yellow; palpi yellow. Pronotum reddish to brownish. Elytron reddish with disc darker but without basal fascia; epipleuron reddish. Ventral surface dark brown to piceous. Legs reddish.

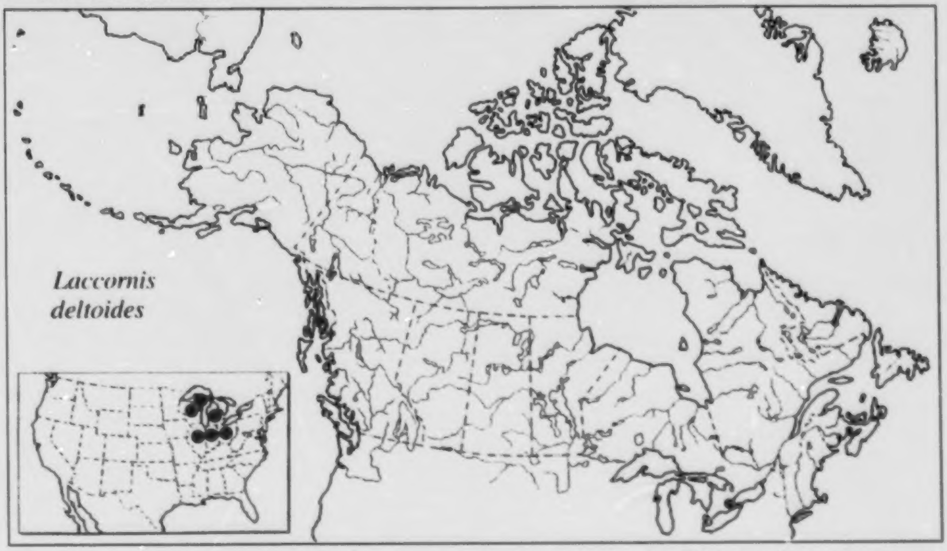
Head with punctures small and moderately dense anteriorly, smaller and less dense posteriorly. Pronotum with disc with punctures very small and moderately dense, smaller and less impressed posteriorly, coarse and dense on posterolateral angle but relatively finer and less dense than in other species. Elytron with punctation and consisting of micropunctures, lateral and sublateral serial punctures with short, inconspicuous setae; epipleuron not punctate. Metasternal wing, metacoxal plate and sterna 1and 2 laterally not punctate or with scattered micropunctures; sternum 6 with punctures fine and sparse. Microreticulation evident over entire dorsal and ventral surface.

Pronotum with posterolateral angle acute; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron disappearing well posterior to shoulder. Prosternum modified, deeply excavate at base of process; process with declivity distinct, file absent and prominence low and rounded; blade broad with medial convexity low and rounded, broadly rounded apically.

Male antennomeres 3 and 4 slightly enlarged, ventrally flattened and with reticulate ventral sculpture, 5 to 7 not modified. Male protibia width = 0.31 mm, ratio width of protarsomeres 1 to 3: width protibia = 0.56 : 0.72 : 0.80; protarsomere 5 not symmetrical in dorsal aspect, with a subapical swelling on anterior side; protarsal claws distinctly modified, anterior claw not toothed medially but slightly contorted. Meso- and metafemur without elongate setae on posterior margin. Aedeagus (Fig. 12J, K) without setae on shaft, apex expanded and truncate with a small reflexed apical lobe.

Ecology. This species occurs in vernally flooded, woodland pools (Hilsenhoff 1994).

Distribution. Map 11. The single Canadian record is a pair of specimens from Guelph, Ontario. In the United States the species is known from Wisconsin, Michigan, Ohio, Illinois and Indiana.



Map 11. *Laccornis deltoides* (Fall). Canadian and Alaskan collection localities and United States state records.

Tribe Methlini Van den Branden 1885

Figs. 9A; 13; 14

Diagnosis. Size small to moderate, length = 2.8 to 6.8 mm. Body (Fig. 13) narrow, elongate and subparallel except pronotum broadly rounded laterally and slightly discontinuous in outline with elytra. Color yellow to reddish brown or piceous, elytra unicolorous or with a lighter basal transverse band. Sculpture of isodiametric meshes, pronotum and elytron variously punctate; abdomen with sparse oblique or transverse strioles. Setae present in punctures but very short and inconspicuous.

Clypeus in lateral aspect smoothly rounded, not produced or modified. Antennomeres relatively short and broad, apical antennomeres slightly broadened apically on some males. Maxillary and labial palpus with apical palpomere cylindrical or fusiform. Pronotum without discal or basolateral plica; lateral bead evident. Scutellum visible (Nearctic *Celina* Aubé) or hidden (Palaearctic and Ethiopian *Methles* Sharp). Elytron with apex produced as a slightly upturned acute spine, bearing two small tufts of setae at its base; lateral margin in lateral aspect sinuate, ascendant to humeral angle; epipleuron impressed basally and hidden behind lateral margin at shoulder, without a basal carina on humeral angle; ventral surface of elytron without a lateral ridge or subapical ligula. Prosternum with lateral pore contiguous with anterior margin, lateral portions not inflated anterior to procoxae; medial declivity slightly to strongly developed, prominence distinct and well differentiated, file present; blade ovate, convex in cross section and bluntly to acutely pointed apically, received into broad V-shaped impression on metasternum and separating mesocoxae. Metacoxal process (Fig. 9A) with hind margin elevated from abdomen and deeply incised each side of midline making hind margin of processes conjointly tripartite; laterally produced as a lobe over base of metatrochanter. Abdomen with tergum 8 with a strongly sclerotized Y-shaped sclerite which ends apically as an acute spine; visible sternum 6 (Fig. 14A) triangular with apex medially produced as a strong spine delimited at base by a transverse ridge and laterally with a setose fovea on each side of base. Pro- and mesotibia strongly dilated apically, strongly spined apically and laterally; pro- and mesotarsi distinctly pentamerous, tarsomere 3 truncate or emarginate apically; hind legs slender, metafemur narrowly separated from coxal lobe by metatrochanter; natatorial setae present on inner margin of metatibia and both sides of metatarsomeres of both male and female; metatarsal claws similar or ventral claw slightly shorter and more arcuate (some male *Methles*).

Male pro- and mesotarsomeres 1 to 3 narrowly dilated, ventrally bearing two to four large oval scales per tarsomere. Male genitalia with parameres (Fig. 14B) symmetrical, with oval basal plate and an elongate apical stylus; aedeagus (Fig. 14C – Q) symmetrical, slender.

Comments. This tribe contains two genera, *Celina* restricted to the New World, and *Methles* Sharp in the Old World, primarily in the tropics. The two genera differ in several characters and Wolfe (1985) suggested the tribe may be polyphyletic. However, the spine-like apices of the elytra, tergum 8 and visible sternum 6 and the laterally emarginate metacoxal processes appear to be good synapomorphies for these genera and as well show a relationship with the tribe Hydrovatini (Wolfe 1989).

Ecology. Young (1979) noted that individuals of *Celina imitatrix* Young burrow into the mucky bottom of ponds and are taken in collecting nets only when the bottom is stirred up and strained. This corresponds with our observations on specimens of both *Celina* and *Methles*. The insects occur in vegetation-rich lentic sites and are generally not collected until the substrates are vigorously disturbed. The beetles apparently occur amongst the roots of aquatic or emergent plants. In the net they are slow to move and are easily overlooked for their pale color blends with that of plant roots The apical spines of the elytra and abdomen are likely used to pierce plant roots and stems allowing the insects to make use of intercellular air when burrowing in sediments (Hilsenhoff 1994). Larvae have recurved extensions of the lateral tracheal trunks that are also likely used to obtain air from aquatic plants (Spangler 1973). These adaptations also contribute to the ability of these insects to occur in relatively deep water such as repoted by Lillie (1991).

Genus *Celina* Aubé 1837

Figs. 13; 14.

Celina Aubé 1837: 218, 219. Type species - *Hydroporus latipes* Brullé, by monotypy.

Diagnosis. With characteristics of tribe. Length = 2.8 to 6.8 mm. Body narrow, elongate and subparallel except pronotum broadly rounded laterally and slightly discontinuous in outline with elytra

Scutellum large and visible. Elytron with apex produced into a short, acute spine; last visible sternum projecting as a sharp spine. Prosternal process sharply stepped downwards between procoxae and delimited anteriorly by a strong transverse ridge or prominence; process obovate, convex in cross section, acutely pointed apically and received into well developed impression on metasternum. Pro- and mesotibia narrow

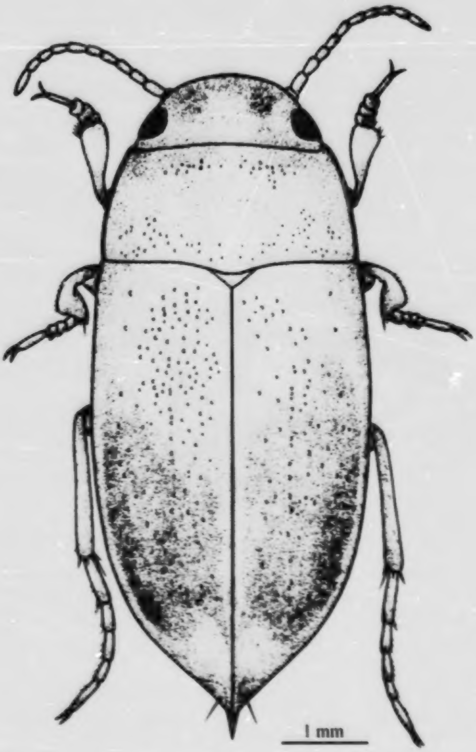


Fig. 13. *Celina hubbelli* Young. Habitus.

basally, strongly widened apically; hind legs slender. Pro- and mesotarsi with 5 tarsomeres visible, tarsomeres 1 to 3 dilated, tarsomere 4 small and partly concealed between lobes of tarsomere 3.

Male mesotibia of many specimens with a deep medial emargination on inner surface. Male paramere with a broad basal piece and an elongate apical strap tipped by setae, aedeagus elongate, completely closed dorsally at base. Female gonocoxa sclerotized, dorsoventrally flattened, elongate and pointed apically, glabrous except a small tuft of apical setae.

Comments. Young (1979) presented a key to the 9 Nearctic species, a modified form of which is given below. This genus is mainly southern and only one species is known from Canada.

Key to species of *Celina* of Canada and the United States
(Modified from Young 1979)

1. Length 6.0 to 6.8 mm; pronotum coarsely punctate, disc anteriorly with punctures subequal in size to those of anterior submarginal transverse row; male protibia not emarginate on inner side; Gulf States and Georgia ....*C. grossula* (LeConte 1863)

1'. Length less than 6.0 mm; pronotum with disk finely punctate, anteriorly with punctures much smaller than those of anterior submarginal row; male protibia with a basal emargination on inner side; widespread 2

2(1). Length 4.4 to 5.6 mm 3

2'. Length 2.8 to 4.3 mm 4

3(2). Length 5.0 to 5.6 mm; elytron with punctation coarse and irregular; pronotum dull with microsculpture meshes large and well impressed, disk with punctation fine and dense, laterally with larger punctures broadly distributed; aedeagus with small subapical lateral denticles (Fig. 14P); Indiana and New Jersey to Florida . . . . *C. imitatrix* Young 1979

3'. Length 4.4 to 5.3 mm; elytron with punctation not conspicuously coarse and irregular; pronotum shiny with microsculpture fine and shallowly impressed, disk with punctation fine and sparse, laterally with larger punctures confined to basal area; aedeagus lacking subapical denticles (Fig. 14Q); Arkansas, Tennessee, Maryland to Florida . . . . *C. slossoni* Mutchler (in Leng and Mutchler 1918)

4(2). Distribution California; aedeagus in dorsal aspect with tip acuminate, lacking a subapical denticle on each side (Fig. 14N,O) . . . . *C. occidentalis* Young 1979

4'. Distribution eastern North America west to Texas; aedeagus various . . . 5

5(4). Pronotum disk with microsculpture almost or quite concealing punctation; aedeagus in dorsal aspect with apex rounded and somewhat spatulate-like, with a subapical lateral denticle on each side (Fig. 14L, M) 6

5'. Pronotum with microsculpture finer, some punctures of disk distinct; aedeagus in dorsal aspect with apex sharply to bluntly pointed, lateral denticles absent 7

6(5). Aedeagus long, slender (Fig. 14L); South Carolina and Tennessee . . . . *C. contiger* Guignot 1947b

6'. Aedeagus shorter (Fig. 14M); North Carolina and Alabama . . . . *C. palustris* Young 1979

7(5). Length 2.8 to 3.2 mm; pronotum disk very finely punctate and with reduced microsculpture so that surface appears shiny; southern Texas; aedeagus as in Fig. 14K . . . . *C. debilis* Sharp 1882a

7'. Length 3.2 to 4.3 mm; pronotum disk not so finely punctate, microsculpture usually distinct 8

8(7). Body uniformly brown or with elytron darker brown than head and pronotum, elytron of some specimens narrowly paler at base and sides; aedeagus as in Fig. 14E, F; length = 3.2 to 3.9 mm; Massachusetts to Florida and Texas .... *C. angustata* Aubé 1838b

8'. Color as above except elytron brown with a distinct, broad pale band across base; aedeagus as in Fig. 14C, D, G, H; length = 3.6 to 4.3 mm; eastern Canada and eastern United States .... *1. C. hubbelli* Young

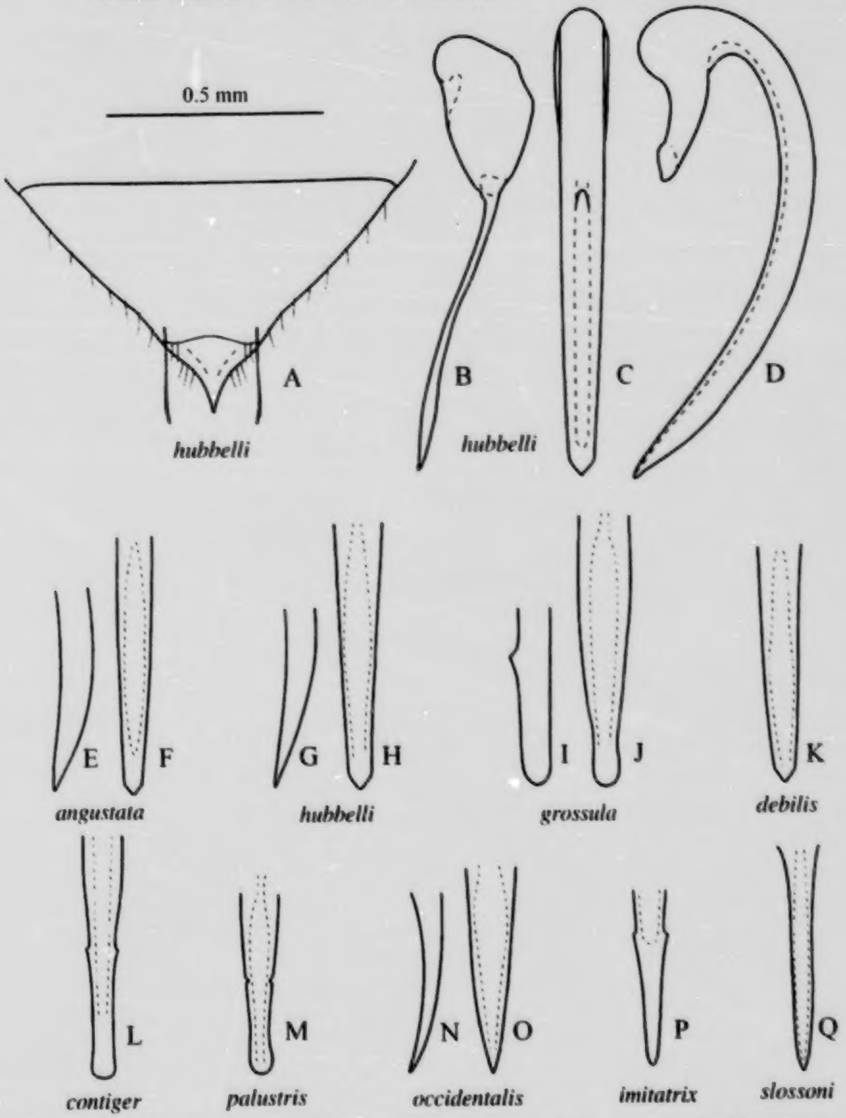

0.5 mm
A
hubbelli
B
hubbelli
C
D
E
F
angustata
G
H
hubbelli
I
J
grossula
K
debilis
L
contiger
M
palustris
N
O
occidentalis
P
imitatrix
Q
slossoni

Fig. 14. *Celina*. A – D, G – H - *C. hubbelli*, A - abdomen sternum 6. B - paramere, C - H - aedeagus dorsal, D – G - aedeagus lateral. E – F - *C. angustata*, E - aedeagus apex lateral, F - aedeagus apex dorsal. I – J - *C. grossula*, I - aedeagus apex lateral, J - aedeagus apex dorsal. K - *C. debilis*, aedeagus apex dorsal. L - *C. contiger*, aedeagus apex dorsal. M - *C. palustris*, aedeagus apex dorsal. N – O - *C. occidentalis*, N - aedeagus apex lateral, O - aedeagus apex dorsal. P - *C. imitatrix*, aedeagus apex dorsal. Q - *C. slossoni*, aedeagus apex dorsal.

1. *Celina hubbelli* Young 1979

Figs. 13; 14A – D, G, H

Celina hubbelli Young 1979: 826. Type locality - Lenawee Co., Michigan.

Selected References. Young 1979: 826; Hilsenhoff 1994: 277.

Description. Length = 3.6 to 4.3 mm; width = 1.6 to 1.9 mm; length: width = 2.25 to 2.38. Body (Fig. 13) elongate and subparallel except pronotum more arcuate laterally than elytra therefore body outline evidently discontinuous in dorsal aspect.

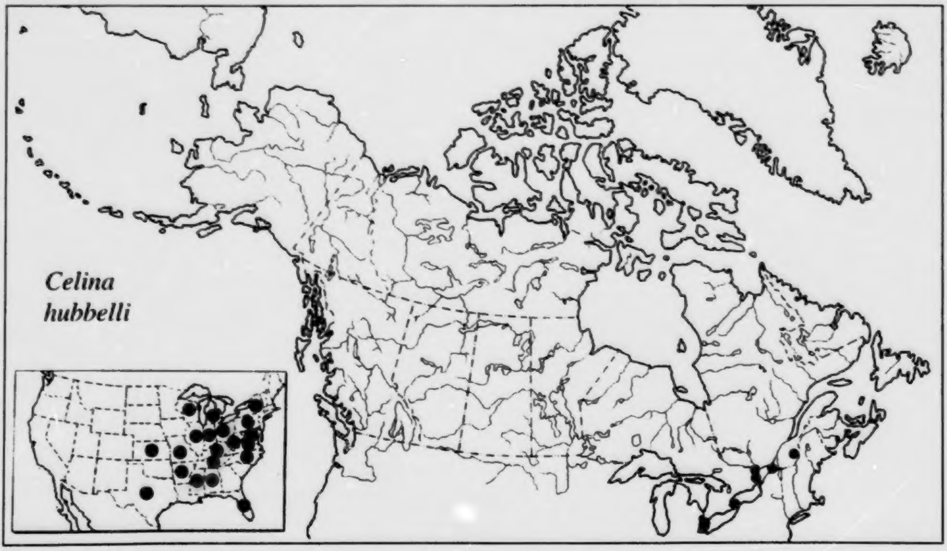
Color reddish yellow to reddish brown, elytron of most specimens with a diffuse darker cloud covering most of disc except a broad basal band, lateral margin and apex pale.

Dorsal surface microreticulate. Pronotum with punctures large laterally, fine but evident medially on disc. Elytron coarsely and irregularly punctate, each puncture bearing a very short inconspicuous seta; inner serial punctures distinct and traceable. Metacoxal plate with transversely stretched meshes and coarse irregular punctation.

Elytron in lateral aspect with lateral margin sinuate and ascendant to humeral angle.

Male mesotibia with a large ventrobasal emargination. Aedeagus (Fig. 14C, D, G, H) slender, without lateral teeth, apex bluntly pointed in dorsal aspect, slender in lateral aspect.

Ecology. Young (1979) and Hilsenhoff (1994) stated the species occurs in muddy bottomed lentic habitats. Hilsenhoff (1994) found the species regularly in ponds and seepages where *Typha* grows. We have also found numerous specimens in the soft muck around the bases of *Typha* stalks. Specimens have been collected at light in June and July.



Map 12. *Celina hubbelli* Young. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 12. The range extends from Ontario to Florida, and west to Michigan, Kansas and Texas.

Tribe Hydrovatini Sharp 1882
Fig. 9B; 15

Diagnosis. Size very small to small, length = 1.8 to 4.0 mm. Body short and broad, subglobose (Fig. 15A). Color testaceous to piceous, elytra unicolorous or maculate. Sculpture of isodiametric meshes or obsolete, elytra distinctly punctate. Vestiture inconspicuous.

Head very broad; clypeus margined anteriorly (obsolete or absent on some exotic species); antenna with antennomeres relatively short and broad, anterior margin more or less serrate; palpi with apical palpomeres fusiform. Pronotum without discal or basolateral plicae; lateral bead evident; posterolateral angle acutely produced. Scutellum hidden by posterior margin of pronotum. Elytron with apex produced and acuminate; without discal striae or plicae but some specimens with a longitudinal sublateral carina or impression posterad of shoulder; lateral margin in lateral aspect strongly sinuate, ascendant to humeral angle; epipleuron impressed basally, with a transverse carina on humeral angle; elytron ventral surface with a well developed sublateral ridge, more or less expanded subapically to form a ligula. Prosternal pore contiguous with anterior margin of prosternum; neck of prosternal process more or less vertically declivous between procoxae; prosternal process broad, limited anteriorly by a transverse ridge or prominence, apex broadly triangular or spatulate, broadly contacting metasternum. Mesocoxae broadly separated; metepisternum contacting mesocoxal cavity. Metasternal wing not contacting epipleuron laterally. Metacoxal process (Fig. 9B) produced as a lobe over base of trochanter; hind margin deeply emarginate lateral to midline so that hind margin of metacoxal processes conjointly tripartite, medial part more or less appressed to level of abdominal sternum 2. Sternum 6 triangular, hind margin medially acutely produced. Pro- and mesotibiae broadly dilated apically; pro- and mesotarsi pseudotetramerous, tarsomere 4 inconspicuous between lobes of tarsomere 3; hind legs slender, metatibia setose along inner margin (may be inconspicuously so) and metatarsomeres along inner and outer margins with natatorial setae in both sexes; metatarsal claws equal.

Male antenna of some species slightly to broadly dilated medially. Pro- and mesotarsomeres narrowly to distinctly dilated, protarsomere 1 ventrally bearing one or two pairs of large round scales, protarsomeres 2 and 3 with none or one pair of scales. Some specimens (non-North American) with stridulatory file along suture between metasternum and metacoxa, plectrum present on mesotibia. Male genitalia with parameres symmetrical, non-jointed, broad with apex recurved mesally; aedeagus arcuate in lateral aspect, slender, apex recurved ventrally in most species.

Comments. This tribe contains two genera, *Queda* Sharp in South and Central America (north to Panama), and the species-rich *Hydrovatus* which is primarily tropical and subtropical with a few species in temperate regions (Biström 1990, 1997). Although of very different body form, the species resemble those of Methlini in possessing acutely produced elytral and abdominal apices, a very broad head and similarly shaped metacoxal processes. Both Wolfe (1985, 1989) and Biström (1997) considered the posteriorly acuminate body a synapomorphy of the Methlini and Hydrovatini. Although members of these tribes are of very different body shape, the similar characters appear to reflect a similar life style. Like specimens of Methlini, *Hydrovatus* specimens occur in bottom mud and silt among the roots of rooted aquatic and emergent plants, often in deeper water than usually occupied by other dytiscid beetles (Lillie 1991; Larson 1997*c)*. Presumably these beetles obtain oxygen supplies within the habitat they occupy rather than by surfacing. Probably the apical spines are used to penetrate plant tissue to access plant intercellular air spaces. The broad head and the coxal structure which allows ventral movement of the leg could be adaptations to burrowing.

Ecology. These insects live amongst the roots of aquatic plants in lentic sites. They occur from the shoreline to depths of over 1.5 m and are often in deeper water than other dytiscids. Beetles are seldom collected unless the bottom materials and plant roots are disturbed and sieved, then specimens may be numerous. In the net the beetles are slow to move and the pale color of many species makes them inconspicuous amongst plant roots and debris.

Genus *Hydrovatus* Motschulsky 1853

Figs. 9B; 15

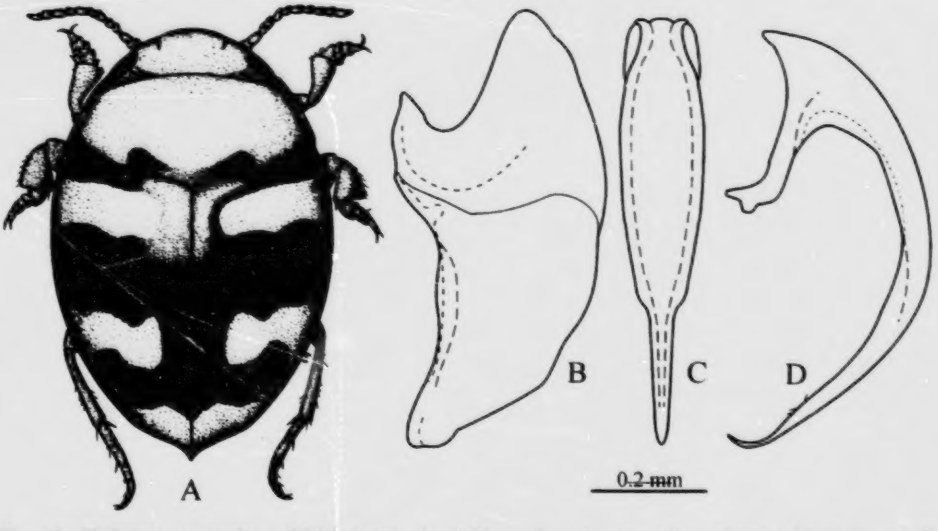


Fig. 15. *Hydrovatus pustulatus* (Melsheimer). A - habitus. B - paramere. C - aedeagus, dorsal aspect. D - aedeagus, lateral aspect.

Hydrovatus Motschulsky 1853: 4. Type species - *Hyphydrus cuspidatus* Kunze 1818, by monotypy.

Diagnosis. With characteristics of tribe. Readily recognized by small size, subglobose shape, margined clypeus, hidden scutellum, apically produced elytral apices, broad prosternal process broadly separating mesocoxae, and tripartite shape of apex of prosternal process.

Comments. This genus contains eight species in North America north of Mexico, of which one is known from southern Canada. Young (1956, 1963*b)* presented keys and descriptions for some of the North American species and Biström (1997) revised the genus on a world basis. The species of the genus are very uniform in most characters although some exotic species show remarkable modifications in the male antenna, protarsi and metacoxal stridulatory organ. Male genitalia, both parameres and aedeagus, vary between species and provide the best characters for species recognition.

Key to species of *Hydrovatus* of Canada and United States

(Modified from Biström 1997)

1. Male antenna modified, antennomeres 3 to 10 distinctly enlarged; length = 2.4 to 2.6 mm; Florida .... *H. platycornis* Young 1963

1'. Male antenna not modified, slenderer; length various. 2

2(1). Elytron with lateral margin posterior to humeral angle with a deep longitudinal groove; length = 3.0 to 3.8 mm; Texas .... *H. hornii* Crotch 1873

2'. Elytron either without a groove behind humeral angle (some specimens with a series of coarser punctures in a shallow longitudinal impression), or if with a distinct longitudinal impression length less than 2.8 mm 3

3(2). Aedeagus in dorsal aspect with sides distinctly expanded at apex; small species, length = 1.9 to 2.2 mm; Florida. ... *H. inexpectatus* Young 1963

3'. Aedeagus in dorsal aspect with apex narrow; size various. 4

4(3). Large species, length = 3.0 to 3.2 mm; aedeagus in dorsal aspect with basal half broad, in lateral aspect more or less evenly curved from base to apex; Florida. .... *H. peninsularis* Young 1953*e*

4'. Smaller species, length = 2.1 to 3.0 mm; aedeagus in dorsal aspect with basal half narrower, in lateral aspect curvature various. 5

5(4). Aedeagus in dorsal aspect (Fig. 15C) with a distinct constriction about middle, distad of which narrow apical portion is broadened then evenly narrowed to apex; many specimens with elytra vaguely to distinctly patterned; length 2.2 to 3.0 mm; widely distributed in eastern North America. .... *1. H. pustulatus* (Melsheimer)

5'. Aedeagus in dorsal aspect without a distinct medial constriction; elytron without an evident pattern; western, Texas to California 6

6(5). Aedeagus in lateral aspect with ventral margin with a more or less distinctly angulate bend distad to middle; body reddish brown with distinctly darker head in most individuals; length = 2.5 to 2.7 mm; Arizona .... *H. leconteii* (Clark 1862)

6'. Aedeagus in lateral aspect with ventral margin more or less evenly curved to almost straight; body more uniformly colored; length = 2.1 to 2.7 mm 7

7(6). Body broad, posterior half pointed; elytron of many specimens with a distinct longitudinal lateral impression; length 2.2 to 2.6 mm; Texas (?) and Utah to California. .... *H. brevipes* Sharp 1882*a*

7'. Body slightly elongated, posterior half not pointed; elytron at most with a slight lateral impression; length 2.1 to 2.6 mm; New Mexico to California. . . . . *H. davidis* Young 1956

1. ***Hydrovatus pustulatus*** (Melsheimer 1844)

Fig. 15

Hygrotus pustulatus Melsheimer 1844: 29. Type locality - Pennsylvania.

Hydrovatus indianensis Blatchley 1910: 212. Type locality - Kosciusko Co., Indiana.

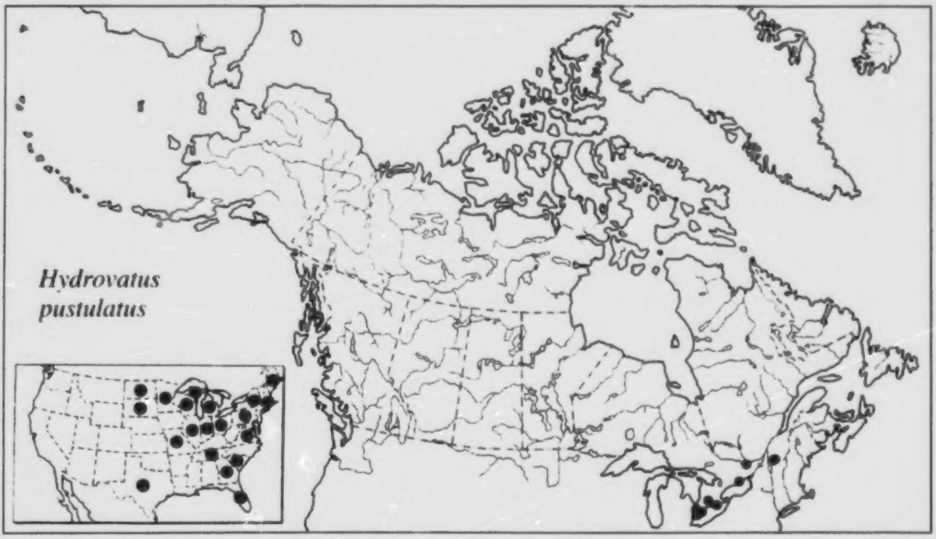
Selected References. Young 1956: 53 – 54; Young 1963b: 189; Hilsenhoff 1994: 278; Biström 1997: 153 – 157.

Description. Length = 2.2 to 3.0 mm; width = 1.4 to 2.0 mm; length: width = 1.43 to 1.54. Body broadly ovate (Fig. 15A).

Body predominantly testaceous to reddish brown; some specimens more or less unicolorous or with elytron more or less uniformly darkened; most specimens with hind margin of pronotum piceous medially, elytron with basal margin (or at least a basal subhumeral spot), sutural margin and broad medial and subapical fasciae, darker brown.

Elytron coarsely and more or less evenly punctate except for a longitudinal series of closely spaced punctures beginning behind shoulder. Dorsal surface with evident reticulate microsculpture. Metasternum and metacoxal plates shiny, reticulation effaced or absent; metacoxal plates strongly punctate.

Clypeus with anterior bead narrow, complete. Metacoxae with median suture slightly elevated, punctures laterad of suture bearing erect brown setae.



Map 13. *Hydrovatus pustulatus* (Melsheimer).Canadian and Alaskan collection localities and United States state records.

Male pro- and mesotarsomeres 1 to 3 evidently dilated, protarsomere 1 with a pair of large round scales beneath; protarsal claws not modified. Aedeagus (Fig. 15C, D) slender, with apex reflexed in lateral aspect, in dorsal aspect abruptly narrowed about middle, several small setae present subapically on ventral surface; paramere (Fig. 15B) large with a small thumb-like apical projection on mesal surface.

Ecology. Specimens occur among vegetation and debris in shallow areas of warm ponds. The larva has been described by Spangler (1962).

Distribution. Map 13. The range extends from southern Ontario and Quebec to Florida and Texas, and west to the Dakotas. Young (1956) recognized two subspecies: *H. p. pustulatus* widely distributed in the eastern United States; and *H. p. compressus* Sharp 1882*a* in Florida and southern Louisiana. However, Biström (1997) noted that different geographical forms existed but as intermediates between them were frequent he could not recognize subspecies.

Tribe Hyphydrini Sharp 1882

Figs. 9C; 16

Diagnosis. Size minute to moderate, length = 1.1 to 5.0 mm. Body broad, subglobose (Fig. 16A).

Color various, testaceous to black, many paler specimens with elytra maculate. Sculpture of fine meshes or absent; dorsal punctation various but usually conspicuous. Vestiture inconspicuous.

Clypeus produced anteriorly as a rim above labrum, margined anteriorly; antenna short to moderate in length, in some specimens slightly thickened apically, not strongly sexually modified; maxillary palpus with apical palpomere fusiform; labial palpus various, penultimate palpomere elongate and cylindrical (Old World *Hyphydrus* Illiger) or short and strongly broadened apically (American genera), distal palpomere with two pale apical papillae or apex distinctly bifid. Pronotum with or without a basolateral plica; lateral bead distinct; hind margin rounded with posterolateral angle more or less right angled or hind margin strongly sinuate on each side of middle and posterolateral angle acutely produced. Scutellum hidden by base of pronotum. Elytron apex not produced; in lateral aspect lateral margin weakly to strongly sinuate in lateral aspect, ascendant to humeral angle, epipleuron impressed basally and with a transverse carina on humeral angle; ventrally with a strong sublateral ridge which is widened subapically forming a large ligula or undulate ridge . Prosternal pore contiguous with anterior margin of prosternum; prosternum with neck of process strongly descendant between procoxae; prosternal process short, broad, apex pointed to broadly truncate, contacting metasternum between mesocoxae or not. Mesocoxae moderately to broadly separated. Metacoxal processes (Fig. 9D) conjointly with hind margin entire, appressed to sternum 2 between leg bases, lateral angle of process not produced laterally over base of metatrochanter. Sternum 6 with apical margin rounded. Legs relatively slender, femora and tibiae approximately subparallel; metatrochanter elongate and widely separating metafemur from coxal cavity; natatorial setae present on inner face of metatibia and inner and outer faces of metatarsomeres on both sexes; pro- and mesotarsi pseudotetramerous; metatarsal claws unequal in length, dorsal claw much shorter and narrower than ventral claw.

Male pro- and mesotarsomeres 1 to 3 various, dilated or not; with or without narrow adhesive scales ventrally. Male genitalia with aedeagus simple to complexly modified (notched apically to almost completely divided); paramere not jointed, form various from simple with no, few or many apical setae to complexly modified (truncate apically with an inner hook and an apical triangular membrane).

Comments. Biström *et al.* (1997) split this tribe into two tribes, Hyphydrini Sharp and Pachydrini Biström *et al.* They assigned the genus *Desmopachria* to Hyphydrini and *Pachydrus* to Pachydrini. The North American members of these genera share two characters, the reduced anterior (dorsal) metatarsal claw and the base of the metatrochanter totally exposed and not covered by the lateral lobes of the metacoxal process, that separate them from all other hydroporines in the fauna and suggest a close relationship. Therefore the more traditional classification of placing both in the same tribe is retained here. This tribe contains 14 genera, none of which is common to both the Old and New Worlds (Pederzani 1995; Biström *et al.* 1997). The two western hemisphere genera, *Desmopachria* (Hyphydrini s. str.) and *Pachydrus* (Pachydrini), are both most diverse in the tropics and subtropics. These insects resemble the ovate species of *Hygrotus* but differ in the structure of the metacoxae which, by being apically appressed to sternum 2, resemble those of the Bidessini (Young 1980).

Key to genera of Hyphydrini of North America

1. Size minute to small, length = 1.1 to 3.0 mm; labial palpus with apical palpomere bifid apically; pronotum with hind margin sinuate laterally, posterolateral angle acutely produced; prosternal process with apex sharply pointed medially or some males with apex forked .... *Desmopachria* Babington

1'. Size larger, length = 4.0 to 5.0 mm; labial palpus with apical palpomere not distinctly bifid apically; pronotum with hind margin straight or slightly convex laterally, posterolateral angle right angled to slightly acute, not produced; prosternal process with apex subtruncate or very broadly rounded .... *Pachydrus* Sharp 1882*a*
[one North American species, *P. princeps* (Blatchley 1914), southeastern United States]

Genus *Desmopachria* Babington 1841
Fig. 16

Desmopachria Babington 1841: 16. Type species - *Desmopachria nitida* Babington 1841, by monotypy.

Diagnosis. Size small, length = 1.1 to 3.0 mm. Body (Fig. 16A) short, broadly oval, convex but dorsal surface variously flattened medially. Labial palpus with terminal palpomere bifid apically. Pronotum of some specimens with a posterolateral impression or plica on each side; basal margin sinuate laterally, posterolateral angle acutely produced. Prosternal process various, in most specimens short and almost as broad as long, rhomboidal with apex acute (some United States specimens sexually dimorphic, male with apex forked (Young 1955*b*). Metasternum between mesocoxae broad (equal in width to about one-half width of mesocoxa), broadly and shallowly impressed anteriorly, with bead remote from anterior margin.

Comments. This is a large, complex genus in tropical to temperate zones of the New World. However, only one species occurs in the northern half of the United States and Canada. Young (1951) gave a key to species of North America but he has subsequently (1980, 1981 *a*, 1981*b*, 1986, 1990) revised many of the species and species groups.

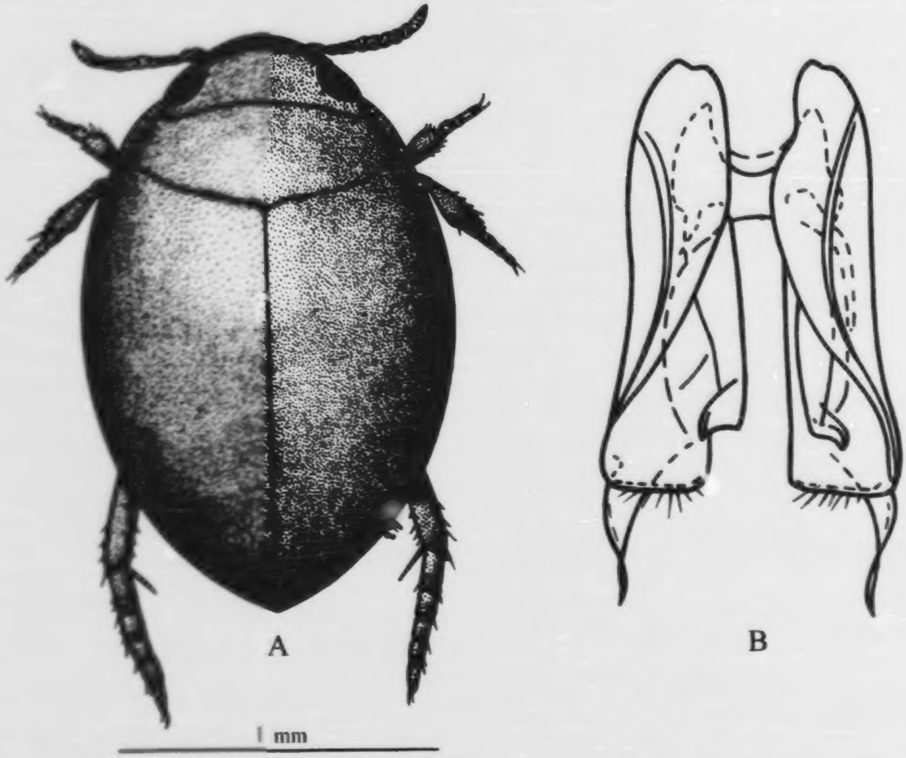


Fig. 16. *Desmopachria convexa* (Aubé). A - habitus. B - male genitalia, aedeagus and parameres, ventral aspect.

Key to subgenera and species of *Desmopachria* Babington of North America

(based on Young 1951, 1980, 1981, 1986)

1. Pronotum with an impressed longitudinal plica or fold on each side of base laterally delimiting a punctate area; larger species, length greater than 2.0 mm; dorsum with a distinct pattern of dark markings. .... .subgenus *Pachriodesma* Guignot 1949, 4

1'. Pronotum without basal plicae or folds; size and color various. 2

2(1). Elytron with an impressed line or stria formed of closely spaced more or less contiguous punctures parallel to sutural margin, line of variable length but evident in at least middle third ofelytron. .... subgenus *Pachriostrix* Guignot 1950 [one species, *D. striola* Sharp 1887, Florida (Young 1990*b*)]

2'. Elytron without an impressed subsutural line. 3

3(2). Male prosternal process with apex forked and not reaching metasternum at middle; length 2.0 mm or more; many specimens with distinct dorsal pattern of dark markings. subgenus *Portmannia* Young 1980 [one species, *D. portmanni* (Clark 1862), Texas and Arizona to Mexico ....(Young 1955*b*)]

3'. Male prosternal process similar in form to that of female, its pointed apex reaching the metasternum; length 1.3 to 1.9 mm; elytron concolorous or diffusely darkened but not distinctly maculate. ....subgenus *Desmopachria* Babington, 8

4(1). Elytron with an antemedian longitudinal impression in a marginal reddish spot; pronotum with a small area adjacent to each plica distinctly depressed; pronotum with punctures on disk as coarse and sparse as those of elytra; California ......*D. latissima* (LeConte 1851)

4'. Elytron without antemedial lateral impressions or reddish spot; pronotum with area adjacent to plica not markedly depressed; pronotum with punctures of disk much finer and denser than those of elytra 5

5(4). Head with hind margin dark; elytron with discal and sutural dark markings united; metacoxal plates relatively coarsely and densely punctate 6

5'. Head uniformly pale, without dark basal margin; elytron with discal marking separated from sutural marking; metacoxal plate more finely and sparsely punctate 7

6(5). Elytra with discal and sutural dark markings connected together forming a large W-shaped mark; pronotum with discal punctation relatively coarse and dense, only slightly finer than that of elytra; metacoxal plates coarsely and deeply punctate; Florida. ....*D. mutchleri* Blatchley 1919

6'. Elytron with lateral dark spots separate from combined discal and sutural markings; pronotum with discal punctation distinctly finer thanthat of elytra; metacoxal plate relatively coarsely but shallowly punctate; Arizona ....*D. mexicana* Sharp 1882*a*

7(5). Body broadly ovate, somewhat depressed; elytra and pronotum rather deeply and densely punctate; metacoxal plates relatively coarsely and densely punctate; Texas to California ....*D. dispersa* (Crotch 1873)

7'. Body more narrowly ovate and more convex; elytra and pronotum more finely and less densely punctate; metacoxal plates more finely and more sparsely punctate; Florida to Louisiana ....*D. seminola* Young 1951

8(3). Size larger, length = 1.5 to 1.9 mm; Nova Scotia to British Columbia,south to Georgia and Texas, absent from Gulf Coastal plain ....1. *D. convexa* (Aubé)

8'. Size smaller, length = 1.3 to 1.7 mm; Florida, Gulf Coast from Georgia to Texas (species can be reliably recognized only on basis of male genitalia) 9

9(8). Abdomen inconspicuously punctate except sternum 6 with coarse setiferous punctation medially and apically; male genitalia with paramere lacking a movable subapical spur, aedeagus sclerotized and apex in ventral aspect produced as a narrow spine, in lateral aspect with a ventral subapical hook; length = 1.3 to 1.55 mm .... *D. leechi* Young 1981*a*

9'. Abdomen finely punctate, sternum 6 not conspicuously coarsely punctate; male genitalia with paramere bearing a moveable subapical spur; aedeagus with apex various; length = 1.35 to 1.7 mm 10

10(9). Aedeagus shorter than lateral aedeagal lobes, weakly sclerotized and broadly rounded apically, in some preparations collapsed and inconspicuous; aedeagal lobes obliquely to squarely truncate apically .11

10'. Aedeagus subequal in length to or longer than lateral aedeagal lobes, partly to distinctly sclerotized; aedeagal lobes pointed apically 12

11(10). Lateral aedeagal lobe with apex obliquely truncate; Texas ; length = 1.64 mm .... *D. defloccata* Young 1981*b*

11'. Lateral aedeagal lobe with apex more or less squarely truncate; Florida to eastern Texas; length = 1.35 to 1.5 mm .... *D. grana* (LeConte 1855)

12(10). Aedeagus in ventral aspect with apex elongate and pointed; Florida and Alabama?; length = 1.4 mm .... *D. aspera* Young 1981*b*

12'. Aedeagus in ventral aspect with apex sclerotized and bifid at tip; Florida; length = 1.4 to 1.7 mm .... *D. cenchramis* Young 1981*b*

1. *Desmopachria convexa* (Aubé 1838)

Fig. 16

Hydroporus convexus Aubé 1838*b*: 479. Type locality - North America.

Selected References. Young 1981*b*: 3; Hilsenhoff 1994: 277.

Description. Length = 1.5 to 1.9 mm; width = 1.0 to 1.20 mm; length: width = 1.44 to 1.51. Small; body globose (Fig. 16A), slightly flattened dorsally.

Color reddish yellow to reddish brown, head and pronotum of many specimens paler than elytra; without dark maculations but base of pronotum and sutural margin vaguely darkened.

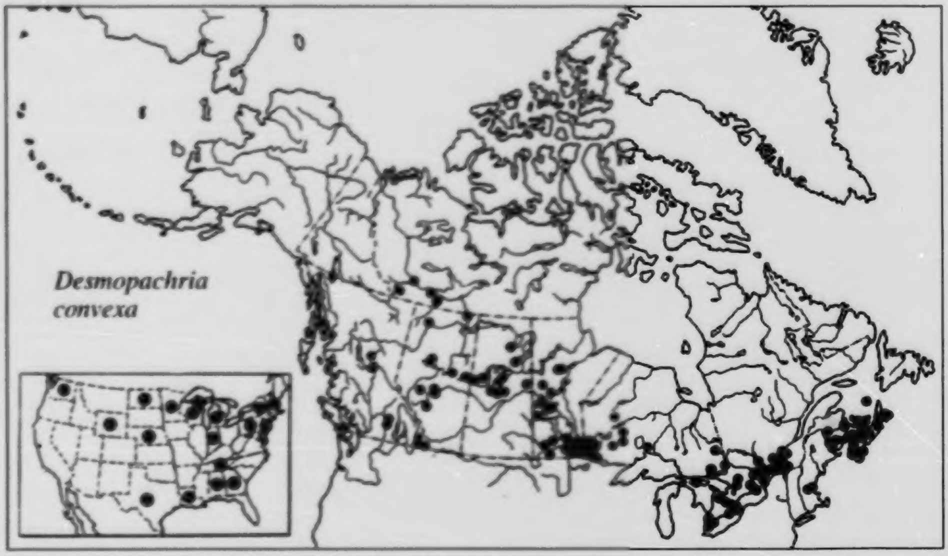
Surface smooth and shiny, without detectable microreticulation. Body distinctly punctate, punctation generally slightly coarser than on similar small species, especially on base of pronotum, base of elytron and outer portions of metacoxal plate; sternum 6 with fine punctures laterally, nearly smooth medially.

Antenna slightly clavate, antennomeres 3 and 4 narrow, more distal antennomeres broader. Pronotum without a basolateral impression or plica on each side. Elytron without a sutural stria.

Sexes similar. Male genitalia as in Fig.16B; paramere with an articulated subapical spur; aedeagus poorly sclerotized and often collapsed in preparation, lateral aedeagal lobes with a twisted triangular apical expansion.

Ecology. Adults are commonly found in saturated mosses at the edge of bog and fen pools. Specimens have also been collected from among dense vegetation and debris at the margin of forest edge pools or from pools in cleared land. The species does not occur in natural grassland ponds. The larva has been described by Barman (1973) and Alarie *et al.* (1997).

Distribution. Map 14. The species is transcontinental in forested regions of southern Canada but does not occur on the prairies. It occurs throughout much of the United States but is apparently lacking from the southeast where similar but generally smaller species occur.



Map 14. *Desmopachria convexa* (Aubé). Canadian and Alaskan collection localities and United States state records.

Tribe Bidessini Sharp 1882
Figs. 9C; 17 – 22

Diagnosis. Size minute to small, length = 1.0 to 4.0 mm. Shape various, body subglobose to elongate.

Color various, elytra of many specimens maculate. Sculpture generally of fine meshes although largely effaced on some specimens or on some lines very dense and surface iridescent; punctation evident, very coarse on some specimens. Vestiture short, sparse and inconspicuous to elongate and conspicuous.

Clypeus produced anteriorly as distinct rim or not; head dorsally with or without a transverse occipital line behind eyes; antenna with basal antennomeres relatively narrow and elongate, medial and apical antennomeres of some species slightly produced on anterior margin so antenna appears subserrate apically; labial palpus with apical palpomere fusiform, its apex bituberculate to bifid. Pronotum of many specimens with a basolateral plica which extends from basal margin anteriorly onto disc, adjacent area of elytron with or without a longitudinal plica. Elytron apex not produced; epipleuron shallowly impressed basally and with (*Brachyvatus*) or without a transverse carina on humeral angle; ventrally with a low sublateral ridge and a subapical ligula. Prosternal process elongate and narrow, contacting metasternum; mesocoxae narrowly separated. Metacoxal processes with hind margin appressed to sternum 2 between leg bases, apicolateral angle produced as a small lobe or narrow projection over base of metatrochanter (Figs. 9C; 17B). Sternum 6 with apical margin rounded or modified. Legs relatively slender, metatibia arcuate, evidently broadened apically; pro- and mesotarsi pseudotetramerous or pentamerous (*Bidessonotus*); metatarsal claws equal in length.

Male pro- and mesotarsomeres 1 to 3 narrowly dilated and ventrally bearing several adhesive setae in most species. Male genitalia with parameres jointed and composed of two or three distinct sections (Figs. 17E; 19A; 20B, D; 21B, D, F); parameres symmetrical or not (*Bidessonotus*), subequal in length to aedeagus. Female ovipositor various but not investigated.

Comments. This is a diverse group in warm temperate to tropical regions of the world. Very few species occur north into the latitudes of Canada. Despite their small size, bidessines exhibit considerable struc[illegible]iversity. Biström (1988) recognized 30 genera for the world fauna and he restricte[illegible]essines to those hydroporines which possess jointed or articulated parameres in the male. This synapomorphy clearly distinguishes the bidessines but the relationships of this tribe to others is obscure. Young placed the taxonomy of the American Bidessini on a sound footing by defining the genera (1967*a*) and compiling a checklist of taxa (1969). Seven genera are recognized from the Nearctic region.

Key to genera of Bidessini of North America
(modified from Young 1967*a*)

1. Head dorsally with a transverse occipital line behind eye (Figs. 17A; 18) 3

1'. Head dorsally lacking occipital line (Fig. 21A) 2

2(1). Metacoxal lines absent; eyes rudimentary . . . . *Comaldessus* Spangler and Barr 1995 [monotypic, *C. stygius* Spangler and Barr 1995, subterranean, Comal Springs, Comal Co., Texas]

2'. Metacoxal lines present; eyes normally developed . . *Uvarus* Guignot, p. 126

3(1). Epipleuron with a basal excavation limited laterally by an oblique humeral carina; elytron lacking a basal plica; clypeus thickened anteriorly, with two small tubercles but without a distinct rim . . . . *Brachyvatus* Zimmermann 1919 [one North American species, *B. apicatus* (Clark 1862), Florida]

3'. Epipleuron without an oblique humeral carina; elytron with a basal plica, but plica may be small and indistinct on some specimens; clypeus various, thickened or not 4

4(3). Pronotum with basal plicae connected by an irregular transverse groove; elytron with a longitudinal carina extending posterad from level of basolateral pronotal plica; clypeus with anterior margin thickened and with two upturned tubercles; body broadly oval, coarsely punctate ....*Anodocheilus* Babington 1841 [two North American species: *A. exiguus* (Aubé 1838*b*), southeastern United States to eastern Texas; *A. francescae* Young 1974, Texas (Young 1974, revision)]

4'. Pronotum with area between basal plicae flat, lacking a transverse groove; elytron without a longitudinal discal carina; clypeus with anterior margin modified or not; body shape and punctation various 5

5(4). Metasternum medially with a pair of lines continuous with metacoxal lines posteriorly then running anteriorly and converging between mesocoxae, the area bounded by metasternal and metacoxal lines flattened or concave (in male) (Fig. 17B); pro- and mesotarsi distinctly 5-segmented ....*Bidessonotus* Régimbart, p. 103

5'. Metasternum without such lines; pro- and mesotarsi apparently 4 segmented, tarsomere 4 small and concealed between lobes of tarsomere 3 6

6(5). Head with transverse occipital line separated from posterior margin ofeye; genal line broadly separated from ventral margin of eye; clypeus with anterior margin prominently extended, in lateral aspect angulate between dorsal and ventral surfaces; body relatively elongate, pronotum cordate with greatest width anterior to middle and hind angle produced, acute and slightly sinuate; length = 2.6 mm; color brown, paler laterally ....*Crinodessus* Miller 1997 [Monotypic, the single species, *C. amyae* Miller 1997, known only from the male holotype collected in a clear desert stream, Presidio Co., Texas].

6'. Head with transverse occipital line contiguous with posterior margin of eye; other characters various; widespread 7

7(6). Clypeus with anterior margin more or less raised or thickened, manyspecimens with a well defined marginal bead but some females with bead reduced to a weakly impressed line at middle; elytron of most specimens brightly patterned with a basically transverse pattern of pale spots or dark irregular fascia ....*Neoclypeodytes* Young, p. 120

7'. Clypeus with anterior margin not or only feebly thickened, if slightly thickened, area not delimited by an impressed line; elytron color various but if with strongly transverse pattern, surface densely punctate and setose 8

8(7). Sternum 6 broad, apical margin only slightly more pointed than semicircular; elytron pattern faint to strong, consisting of longitudinal dark vittae; metacoxal plate and epipleuron smooth, punctation obsolete or very fine and sparse; aedeagus in lateral aspect with apex produced ventrally at right angles into a spine or beak-like process .... *Neobidessus* Young 1967*a* [two North American species: *N. pullus* (LeConte 1855), male inner metatibial spur broad, subparallel and apically truncate, southeastern United States; and *N. pulloides* Young 1977, male spur unmodified, Texas (Young 1977, 1981*c*)]

8'. Sternum 6 narrower, somewhat triangular in shape with apex narrowlyrounded; elytron color various, unicolorous, with transverse vittae or broken irregular longitudinal lines and blotches; metacoxal plate and epipleuron with punctation various but on most specimens punctures deep and conspicuous; aedeagus with apex simple, without a spine or beak-like process (Fig. 19) ....*Liodessus* Guignot, p. 107

Genus *Bidessonotus* Régimbart 1895

Fig. 17

Bidessonotus Régimbart 1895: 331. Type species - *Bidessonotus obtusatus* Régimbart, designated by J. Balfour-Browne 1947.

Diagnosis. Length = 1.7 to 2.3 mm. Shape elongate, pronotum and elytra slightly discontinuous in outline (Fig. 17A).

Dorsal surface reticulate, some females with elytra iridescent from very dense lines of sculpture; metacoxal plate coarsely punctate. Dorsal surface distinctly setose.

Head with occipital line behind eyes; clypeus at most slightly thickened, anterior margin not modified. Pronotum with basolateral plicae well impressed, plicae not connected by a transverse groove or impression on pronotal disc. Elytron with basal plica deeply impressed; epipleuron without a transverse carina at shoulder. Metasternum (Fig. 17*b)* with a pair of strong medial lines, these converge anteromedially between mesocoxa then diverge posterad to connect with the subparallel coxal lines, thus delimiting a flattened or concave medioventral platform; metasternal wing very narrow. Pro- and mesotarsi distinctly pentamerous, tarsomere 4 short but not concealed by lobes of tarsomere 3.

Sexually dimorphic, male with metasternum and metacoxae medially concave in lateral aspect, and mesotibia curved; female not so modified, ventral surface of body straight. Male genitalia with parameres (Fig. 17E) two-segmented, not symmetrical; aedeagus (Fig. 17F) asymmetrical, apex variously deflected at right angles to shaft.

Comments. The genus contains 29 described species, the majority of which occur in Central and South America. Four species are known from Canada and the United States. J. Balfour-Browne (1947) revised the genus. Young (1990*a)* reviewed the genus and described additional species. The species are very similar to one another but can be readily identified by the peculiar shapes of the aedeagus.

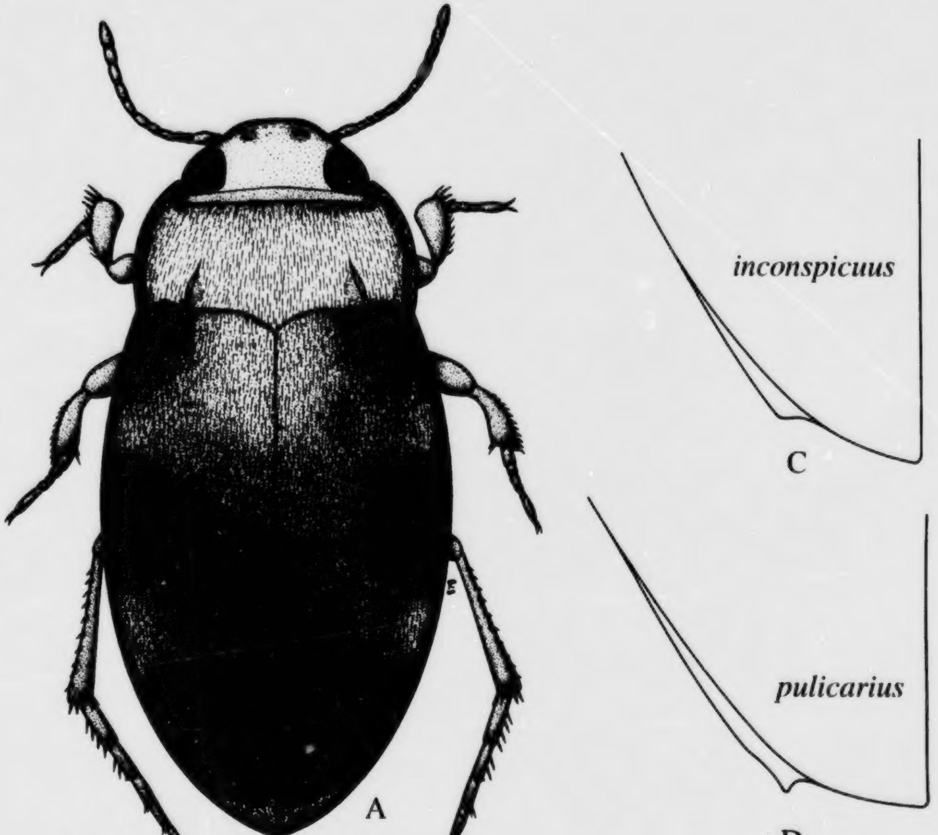

inconspicuus
C
pulicarius
D
A
0.5 mm
inconspicuus
i
B
inconspicuus
E
F
G
inconspicuus
pulicarius
0.5 mm

Fig. 17. ***Bidessonotus*****. A - *B. inconspicuus*, habitus. B - *B. inconspicuus*, metathorax ventral. C – D - female elytral apex ventral, C - *B. inconspicuus*, D - *B. pulicarius*. E – F - *B. inconspicuous*, E - paramere, F - aedeagus lateral. G - *B. pulicarius*, aedeagus lateral.**

Young (1990*a)* stated these beetles occur in both small pools and very slow streams where dense vegetation and accumulation of organic debris occurs. Specimens are often taken at light.

Key to males of species of *Bidessonotus* of Canada and United States

1. Aedeagus in lateral aspect with distal face of reflexed apex with an acute spine; end of reflexed apex sharply pointed; Texas .... *B. mexicanus* Regimbart 1895

1'. Aedeagus in lateral aspect with distal face of reflexed apex not bearing a distinct spine; end of reflexed apex more or less truncate; widespread in eastern North America 2

2. Aedeagus in lateral aspect with a longitudinal crest on dorsal surface above reflexed apex 3

2'. Aedeagus in lateral aspect with a small tooth or ridge on dorsal surfaceabove reflexed apex, without a distinct crest (Fig. 17F); southeastern Canada, eastern United States ... *1. B. inconspicuus* (LeConte)

3(2). Aedeagus in lateral aspect with a spine on proximal surface of reflexed apex; shaft proximad of reflexed apex with setae on ventral surfacem (Fig. 17G); southeastern Canada, eastern United States .... *2. B. pulicarius* (Aubé)

3'. Aedeagus in lateral aspect without a spine on proximal surface of reflexed apex; shaft proximad of reflexed apex without setae on ventral surface; Georgia, Florida and Alabama ..... *B. longovalis* (Blatchley 1919)

1. *Bidessonotus inconspicuus* (LeConte 1855)

Fig. 17A - C, E, F

Hydroporus inconspicuus LeConte 1855: 290. Type locality - Louisiana.

Selected References. Balfour-Browne 1947: 432 – 433; Young 1954: 74 – 75; 1969: 2; 1990a: 361 – 362.

Description. Length = 2.0 to 2.3 mm; width = 1.0 to 1.1 mm; length: width = 2.00 to 2.11. Body (Fig. 17A) elongate oval, lateral margins of pronotum and elytra strongly discontinuous in dorsal outline.

Head and pronotum mainly testaceous to pale rufous; antenna yellow basally, antennomeres 6 to 11 infuscate; palpi yellow with apical infuscation. Elytron brownish to light piceous, lateral margin paler and on most specimens expanded to form vague postmedial and subapical spots, disc without distinct maculations but with poorly defined sublateral darker spots near middle and subapically. Ventral surface pale reddish brown with metacoxal plates and sterna 1 to 3 darker brown.

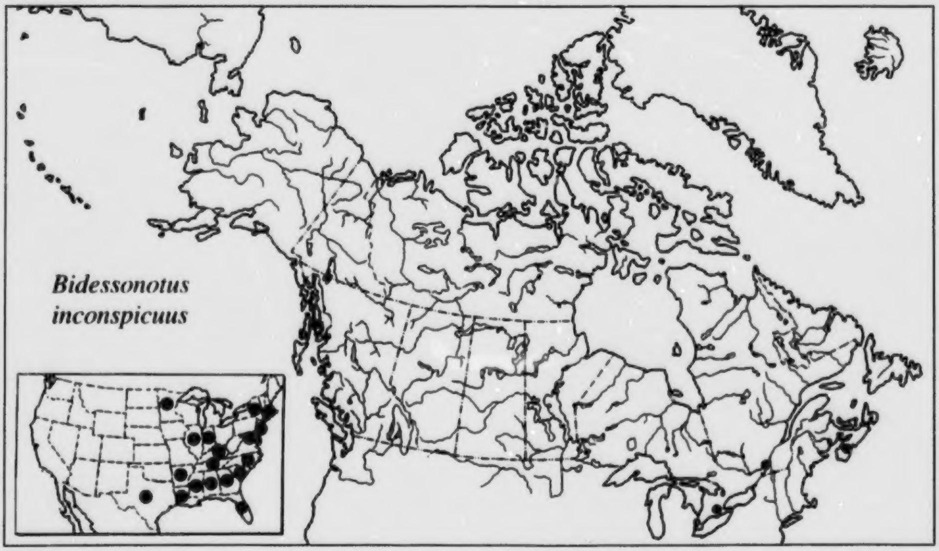
Head with a band of setiferous punctures between eyes anterad of occipital line, frons anteriorly with punctures smaller, sparser and lacking evident setae; lacking microreticulation. Pronotum with distinct, setiferous punctures evenly spaced medially, punctures larger and denser near basal margin; disc lacking microreticulation. Elytron densely punctate, each bearing an elongate, suberect pale seta; male with surface lacking microreticulation basally, apex evidently reticulate; female with dense transverse lines making surface faintly iridescent; epipleuron finely and sparsely punctate. Metasternal wing very narrow, with a few small punctures. Metacoxal plate with coarse, evenly spaced punctures. Sterna 1 and 2 with coarse punctures, slightly smaller than those of metacoxal plate.

Palpi bifid apically. Antenna broad, antennomeres 6 to 8 subtriangular in outline. Pronotum with lateral bead fine; posterolateral angle produced and acute.

Female elytron (Fig. 17C) produced subapically into a broad, sharp-tipped tooth. Male mesofemur with ventral margin straight to slightly concave basally and medially, with a small tumidity or tooth subapically (best seen in posterior aspect). Mesotibia in both sexes with outer margin broadly and convexly arcuate, male with inner margin slightly concave, female with inner margin more or less straight. Male protarsomeres 1 to 3 evidently dilated, 1 longer and broader than 2 which in turn is larger than 3. Male genitalia with aedeagus (Fig. 17F) in lateral aspect axe-shaped, apical part in form of a flattened, ventrally directed blade, dorsal to reflexed apex with a small tooth but without an elongate crest.

Ecology. Young (1954) stated the species occurs mainly in lentic habitats. Specimens were collected in Nova Scotia at the margins of a permanent gravel pit pool. At the time of collection, early May, water shallowly flooded bank-side mosses and tufts of grass which were sparsely distributed on clay and gravel soil. The beetles were in inundated vegetation at the water's edge. At normal water level, much of the pool edge would be bare clay and gravel with pockets of emergent *Juncus*, patches of moss and probably filamentous algae.

Distribution. Map 15. The range extends from Nova Scotia and southern Quebec and Ontario south to Florida and Texas.



Map 15. ***Bidessonotus inconspicuus*** **(LeConte). Canadian and Alaskan collection localities and United States state records.**

2. *Bidessonotus pulicarius* (Aubé 1838)
Fig. 17D, G

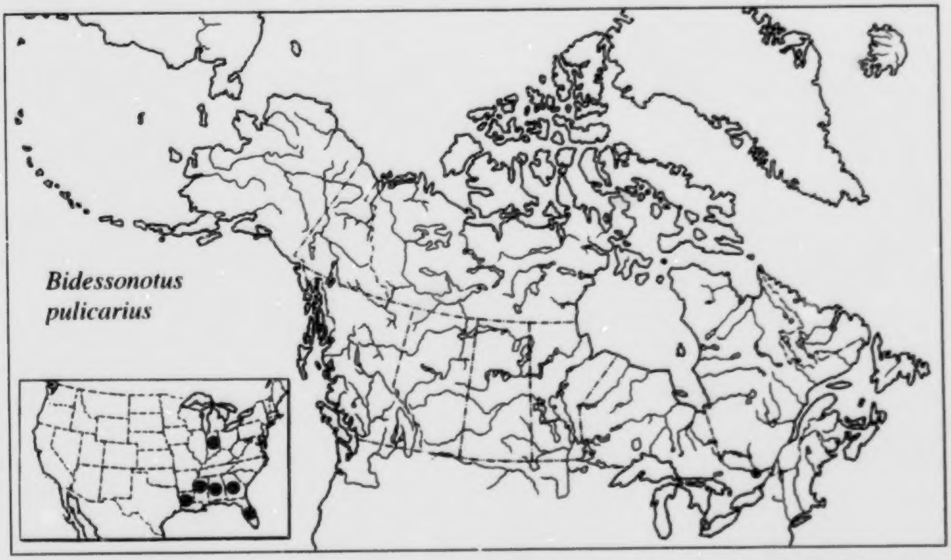
Hydroporus pulicarius Aubé 1838*b*: 494. Type locality - "Am. Bor."

Selected Reference. Balfour-Browne 1947: 433 – 435.

Description. Length = 1.9 to 2.0 mm; width = 0.9 to 1.0 mm; length: width = 2.00 to 2.11. Very similar to *B. inconspicuus*, slightly smaller, separable with certainty only on the basis of the male genitalia. Aedeagus (Fig. 17G) with apical reflexed piece broader, more parallel-sided, shaft dorsally above reflexed piece with a longitudinal crest. Female elytron (Fig. 17D) with subapical tooth slightly more acute and prominent than in *B. inconspicuus*.

Ecology. Canadian specimens have been collected at light.

Distribution. Map 16. The range extends from southern Ontario to Florida. The only definite Canadian record is a male and a female specimen collected at light (Aylmer, PQ, 29 May 1989, L. LeSage, CNC).



Map 16. ***Bidessonotus pulicarius*** **(Aubé). Canadian and Alaskan collection localities and United States state records.**

Genus *Liodessus* Guignot 1939
Figs. 9C; 18; 19

Liodessus Guignot 1939: 53. Type species - *Hydroporus affinis* Say, original designation.

Diagnosis. Length = 1.5 to 2.3 mm. Shape elongate (Fig. 18), many specimens with pronotum more rounded laterally than elytra so outline discontinuous. Elytron with color pattern various, unicolorous, with blotches and elongate stripes or with transverse markings. Vestiture inconspicuous or prominent. Metacoxal plate finely to coarsely punctate.

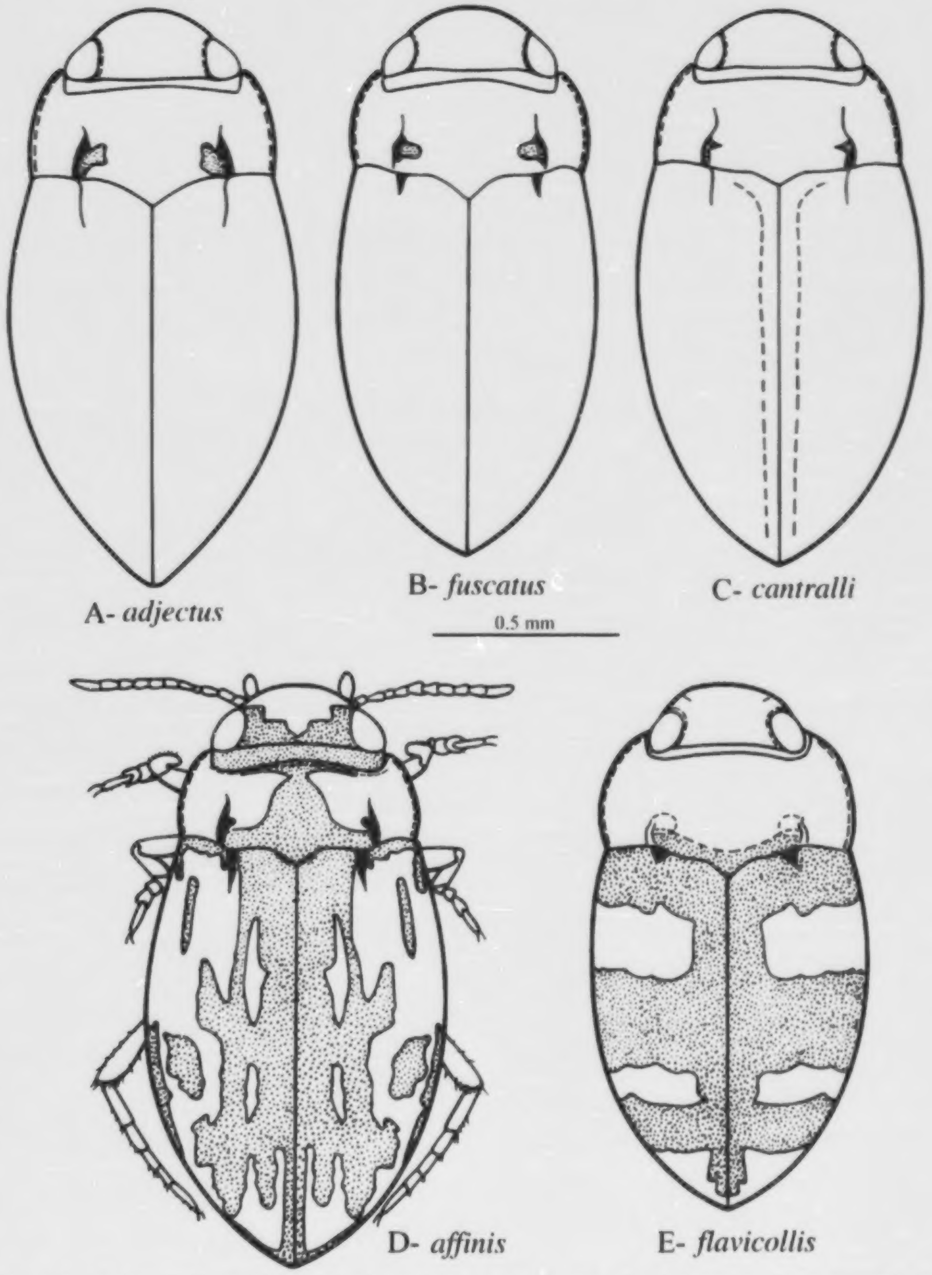

A- adjectus
B- fuscatus
C- cantralli
0.5 mm
D- affinis
E- flavicollis

Fig. 18. *Liodessus*. Body outline and color pattern. A - *L. adjectus*. B - *L. fuscatus*. C - *L. cantralli*. D - *L. affinis*. E - *L. flavicollis*.

Head with an occipital line behind the eyes. Clypeus with anterior margin simple, evenly convex and not thickened into a raised bead or rim, without anteriorly projecting points. Pronotum with laterobasal plica present but of various lengths, from less than one-quarter to almost three-quarters length of pronotum. Elytron with basal plica variously developed, from absent or impressed only at very base to well developed and clearly extending onto disc; sutural striae lacking or some specimens with a subsutural series of punctures forming a traceable groove on basal half of disc; epipleuron without a transverse carina on shoulder. Metasternum lacking anteriorly converging medial lines. Pro- and mesotarsi pseudotetramerous, tarsomere 4 concealed between lobes of tarsomere 3. Sternum 6 narrow and subtriangular in shape, impressed basally at sides.

Male genitalia with parameres (Fig. 19A, C, E, G, J) slender and jointed medially; aedeagus simple (Fig. 19B, D, K – N) although apex with a small dorsal hook on some specimens (Fig. 19F, H, I).

Comments. As presently defined, the genus occurs in North and South America, Africa and Australia. However, there are regional differences in such characters as the shape of the parameres and punctation of the ventral surface of the body (Larson 1994*b*). The genus is probably polyphyletic and should be broken up, at least into subgenera. The North American species are fairly homogeneous except for *L. flavicollis* and *L. hobbsi* which differ from the others in a number of features including shape, punctation and color pattern. Young (1969) listed 23 New World species. Larson and Roughley (1990) reviewed the North American species but did not deal with the problem of classification. Also, they recognized that at least *L. affinis* may be a complex of species and recommended further study to resolve its status. Such a study was undertaken by Miller (1998) who in a careful study showed that *L. affinis*, as defined by Larson and Roughley (1990), was composite and contained four similar species separable only on the shape of the aedeagus.

Ecology. These small beetles occur in lentic habitats or in very shallow water at the margin of streams. They are usually associated with dense vegetation or filamentous algae.

Key to species of *Liodessus* of North America

(Modified from Larson and Roughley 1990, Miller 1998)

1. Elytron with basal plica lacking or represented by at most a very small impression which is not produced linearly onto disc (Fig. 18E); metacoxal plate and metasternum medially coarsely punctate 2

1'. Elytron with a basal plica originating adjacent to base of pronotal plica, length of plica various but always evidently linear and longitudinal in shape (Fig. 19A – D); metacoxal plate and metasternum with punctation various 3

2(1). Elytron fuscous with sub-basal, submedial and apical transverse pale fasciae (Fig. 18E), some specimens with elytron entirely fuscous; elytron very densely punctate, punctures separated less than their diameters, conspicuously setose; widespread in eastern North America .... *1. L. flavicollis* (LeConte)

2'. Elytron more or less uniformly yellowish brown, without distinct maculation; elytron coarsely punctate but punctures sparser and separated by distances about equal to their own diameter, less conspicuously setose; Florida .... *L. hobbsi* (Young 1950)

3(1). Elytron yellow with longitudinal brown vittae (Fig. 18D), or if mainly dark brown, with a few longitudinal discal, paler spots; metatibia mainly yellow with distinct infuscation limited to apical third, although some specimens with vague medial infuscation; metacoxal plate with punctures fine, on many specimens obscured by rugose sculpture; elytron with plica well developed, length plica: length elytron = 0.06 to 0.16 .... *L. affinis* complex, 4

3'. Elytron uniformly brown to piceous, or if with pale discal markings, metacoxal plate coarsely punctate and elytral plica short, length plica: length elytron = 0.02 to 0.08; metatibia with distal two thirds distinctly infuscate 7

4(3). Aedeagus in dorsal aspect with apex broadly rounded and somewhat spatulate, in lateral aspect aedeagus evidently narrowed subapically and narrow apex slightly sinuate; known only from Death Valley, California .... *L. saratogae* Miller 1998

4'. Aedeagus in dorsal aspect evenly narrowed to narrowly rounded or acute apex, in lateral aspect more or less evenly narrowed apically and not evidently sinuate; widely distributed 5

5(4). Aedeagus in lateral aspect (Fig. 19N) distinctly broadened near middle of length, width at broadest point approximately twice minimum width of proximal half; aedeagus in dorsal aspect more or less inflated subapically and lateral margins slightly to distinctly bisinuate; western North America, east to about eastern limits of Great Plains .... 4. *L. obscurellus* (LeConte)

5'. Aedeagus in lateral aspect (Fig. 19K - M) of more or less even width throughout length, in dorsal aspect sides more or less parallel or converging apically and not evidently sinuate subapically; mainly east of Great Plains 6

6(5). Aedeagus in lateral aspect more or less evenly curved over length (Fig. 19K, L); paramere narrower (Fig. 19J); northeastern United States and eastern Canada .... 2. *L. affinis* (Say)

6'. Aedeagus in lateral aspect with apical portion more or less straight or slightly upturned (Fig. 19M); paramere broader; Atlantic and Gulf Coasts, uncommon inland .... 3. *L. noviaffinis* Miller

7(3). Elytron, on at least basal half, with a sutural groove formed by a longitudinal series of relatively deeply impressed punctures (Fig. 18C); body in dorsal aspect with lateral margin of pronotum and elytra forming a more or less continuous curve; metasternum medially finely and inconspicuously punctate .... 5. *L. cantralli* (Young)

7'. Elytron without a distinct subsutural groove (Fig. 18A, B); body in dorsal aspect with lateral margin of pronotum and elytron strongly discontinuous; metasternum medially distinctly punctate 8

8(7). Pronotum with lateral plica long, 0.67 to 0.88 length of pronotum measured at same point (Fig. 18A); elytron with basal plica well developed, length plica: length elytron = 0.09 to 0.12; metacoxal plate with coarse punctures few in number, shallower and irregularly distributed . . . . *6. L. abjectus* (Sharp)

8'. Pronotum with lateral plica short, 0.48 to 0.63 length of pronotum measured at same point (Fig. 18C); elytron with basal plica short, length plica: length elytron = 0.02 to 0.08; metacoxal plate with coarse punctures more or less evenly distributed . . . .*7. L. fuscatus* (Crotch)

1. *Liodessus flavicollis* (LeConte 1855)

Figs. 18E; 19I

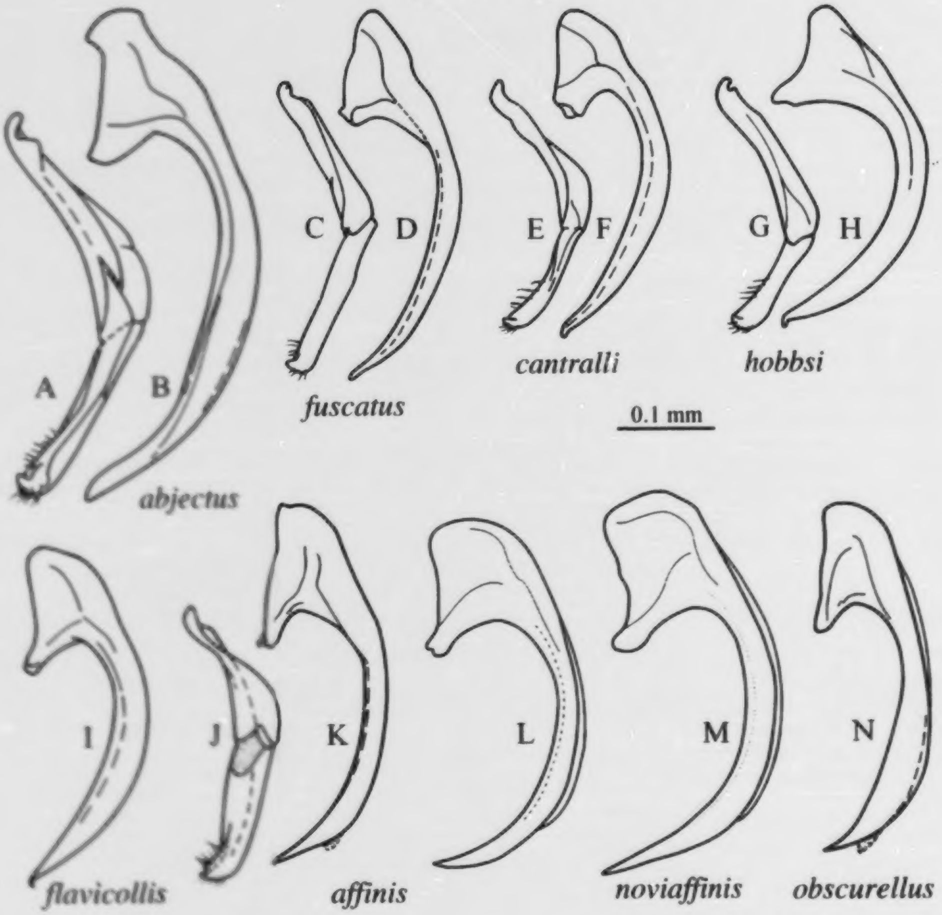

A
B
abjectus
C
D
fuscatus
E
F
cantralli
G
H
hobbsi
0.1 mm
I
flavicollis
J
K
affinis
L
M
noviaffinis
N
obscurellus

Fig. 19. *Liodessus*, male genitalia. A– B - *L. abjectus*, A-paramere, B-aedeagus lateral. C – D - *L. Fuscatus*, C-paramere, D-aedeagus lateral. E – F - *L. cantralli*, E-paramere, F-aedeagus lateral. G – H - *L. hobbsi*, G - paramere, H - aedeagus lateral. I - *L. flaviocollis*, aedeagus lateral. J – L -*L. affinis*, J - paramere, K – L - aedeagus lateral. M - *L. noviaffinis*, aedeagus lateral. N – *L* - *obscurellus* aedeagus lateral.

Hydroporus flavicollis LeConte 1855: 291, 295. Type locality - New York.

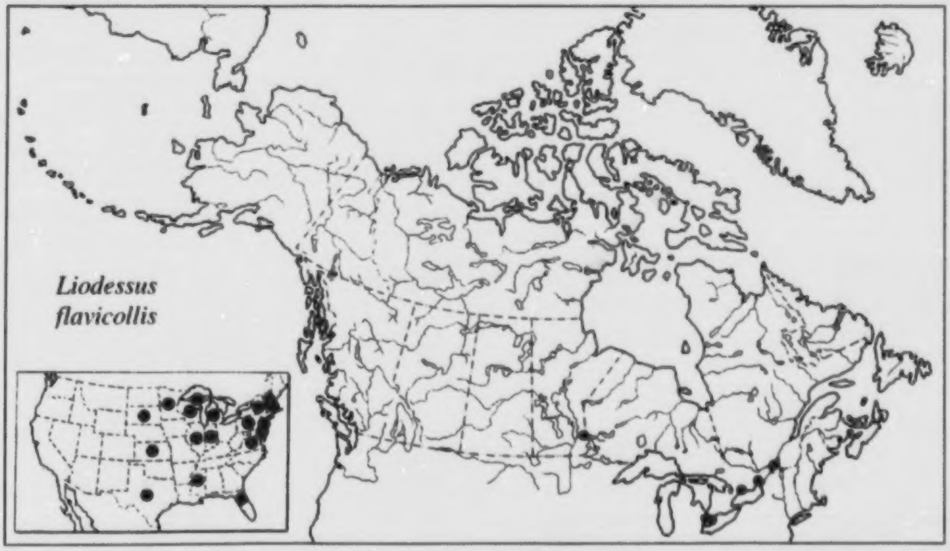
Selected References. Larson and Roughley 1990: 242 – 243; Hilsenhoff 1994; 289; Miller 1998: 311.

Description. Length = 1.5 to 1.8 mm; width = 0.8 to 1.0 mm; length: width = 1.81 to 1.94. Body (Fig. 18E) broad, lateral outline strongly discontinuous between pronotum and elytron.

Color of most specimens distinctive. Head pale; pronotum pale except basal margin between lateral plicae, narrowly fuscous; elytra fuscous with pale transverse spots situated sub-basally, submedially and apically, these spots contiguous with pale lateral margin but separated from suture by fuscous area (specimens deviating from this pattern have been observed as follows: dark area of elytron expanded so that pale fascia are largely reduced or eliminated; and pale areas expanded so that fascia are longitudinally confluent subsuturally); ventral surface of body various, entirely yellow to brown. Antenna yellow basally, infuscate apically.

Dorsal surface of body densely punctate, elytron with punctures closely spaced and somewhat confluent forming irregular transverse series; punctures bearing conspicuous, slightly flattened setae; epipleuron densely punctate. Ventral surface with metasternum medially and metacoxa densely and coarsely punctate.

Pronotum in dorsal aspect broad, lateral margin arcuate and not forming a continuous curve with elytron; basal margin more or less straight laterad of plica, posterolateral angle not produced; basolateral plica poorly delimited, short, approximately 0.25 to 0.33 length of pronotum measured along same line. Elytra relatively short and oval, in lateral aspect dorsal surface strongly convex and sharply descendant apically; basal plica absent or represented by a very short, poorly defined impression; in lateral aspect lateral margin broadly arcuate, curving downwards to near apex; epipleuron broadly visible to humeral angle. Metacoxal lines evidently diverging anteriorly.



Map 17. ***Liodessus flavicollis*** **(LeConte). Canadian and Alaskan collection localities and United States state records.**

Aedeagus (Fig. 19I) in lateral aspect evenly arcuate, apex with a small dorsal hook.

Ecology. These beetles are usually found in algal mats in relatively deep water (Lillie 1991). Most collections are from clear-water pools or ponds with sandy substrates. All specimens examined from Canada and the northeastern United States have their wings reduced to small stubs.

Distribution. Map 17. The distribution extends from southern Quebec, Ontario and Manitoba to Florida and northern Texas.

2. *Liodessus affinis* (Say 1823)

Figs. 18D; 19J – L

Hydroporus affinis Say 1823: 104. Neotype - male, 5 mi NW Davidsburg, York Co., Pennsylvania, in USNM. (designated by Miller 1998).

Selected Reference. Miller 1998: 293 – 301 (previous records refer to various members of the *L. affinis* complex).

Description. Length = 1.7 to 2.1 mm; width = 0.9 to 1.0 mm; length: width = 1.86 to 2.02. Body (Fig. 18D) in dorsal aspect ovate, lateral margins of pronotum and elytra more or less continuous in outline or with a slight discontinuity.

Color various, dorsal surface basically yellow to reddish with darker markings as follows: hind margin of head, a central spot on pronotum and more or less linear maculations on elytra, extent of dark markings varied, some specimens almost entirely pale, others with most of dorsal surface dark; ventral surface of body with at least metasternum and metacoxal plates dark brown, many specimens with most of ventral surface dark. Legs mainly yellow, metatibia distinctly darkened only on apical third. Antenna with antennomeres 1 to 4 yellow, outer antennomeres darkened.

Pronotum finely punctate except punctures deeper and denser medially on darkened area and posteriorly between plical bases. Elytron with conspicuous punctures separated by one and one-half to two times their own diameters, each bearing a conspicuous but short pale seta; epipleuron with punctation obsolete. Metasternum inconspicuously punctate. Metacoxal plate rugose, rugae largely obscuring sparse, shallow punctures. Male body smooth and polished between punctures; female with variously developed microreticulation, body may be smooth like male, with apex of elytron reticulate or entire body reticulate.

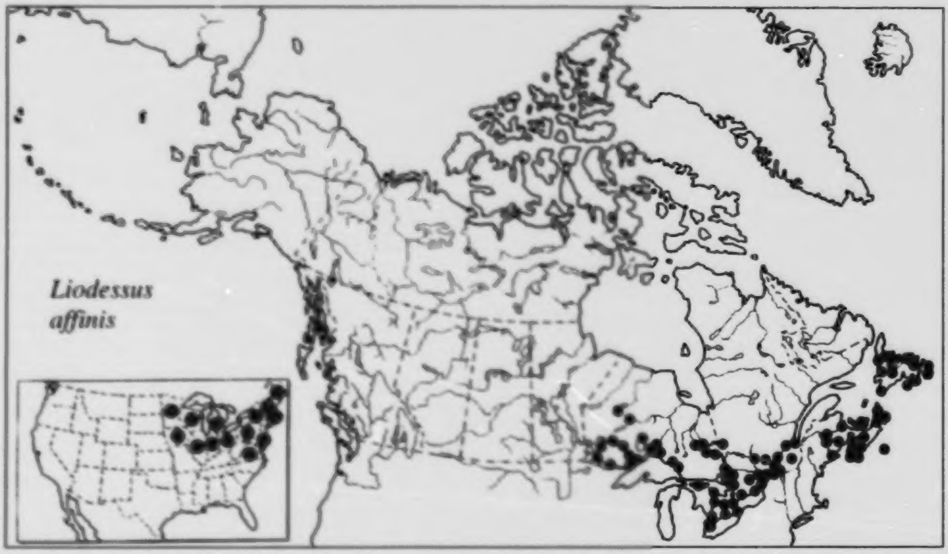
Pronotum widest at hind angles; basal margin slightly arcuate laterad of plica, posterolateral angle slightly produced; lateral bead broadest basally, slightly narrowed anteriorly; plica well developed, sharply limited laterally, about one-half to two-thirds as long as pronotum measured along same line. Elytron with plica well developed, 0.06 to 0.16 length of elytron; epipleuron in lateral aspect disappearing shortly posterad of humeral angle on most specimens. Metacoxal lines diverging anteriorly.

Aedeagus (Fig. 19K, L) in lateral aspect evenly curved and of even width to near apex, apex not upturned; in dorsal aspect lateral margins parallel basally and convergent apically to narrowly rounded apical point. Paramere (Fig. 19J) moderately broad basally.

Comments. The above description, aside from details of the male genitalia, applies well to the following two species. The species of the *L. affinis* complex are largely parapatric but there are broad zones of overlap, especially between *L. affinis* and *L. obscurellus* in the upper Mississippi Valley and between *L. affinis* and *L. noviaffinis* along the northern Atlantic coast where distribution alone can not be used to separate species.

Ecology. These beetles have been collected from a wide variety of habitats, both temporary and permanent ponds, slow streams and pools adjacent to streams. Typically they are found in shallow, sun-warmed water where there is no or little current and either dense vegetation or filamentous algae.

Distribution. Map 18. The Canadian range extends from Newfoundland to western Ontario and in the United States includes the Great Lakes and northern Appalachian states. Canadian specimens for which collection localities are indicated on the map were assigned to species based on distribution rather than examination of male genitalia. United States records are from Miller (1998).



Map 18. *Liodessus affinis* (Say). Canadian and Alaskan collection localities and United States state records.

3. *Liodessus noviaffinis* Miller 1998

Fig. 19M

Liodessus noviaffinis Miller 1998: 301 – 303. Type locality - Gainesville-Forest Insect Lab., Alachua Co., Florida. Type in USNM.

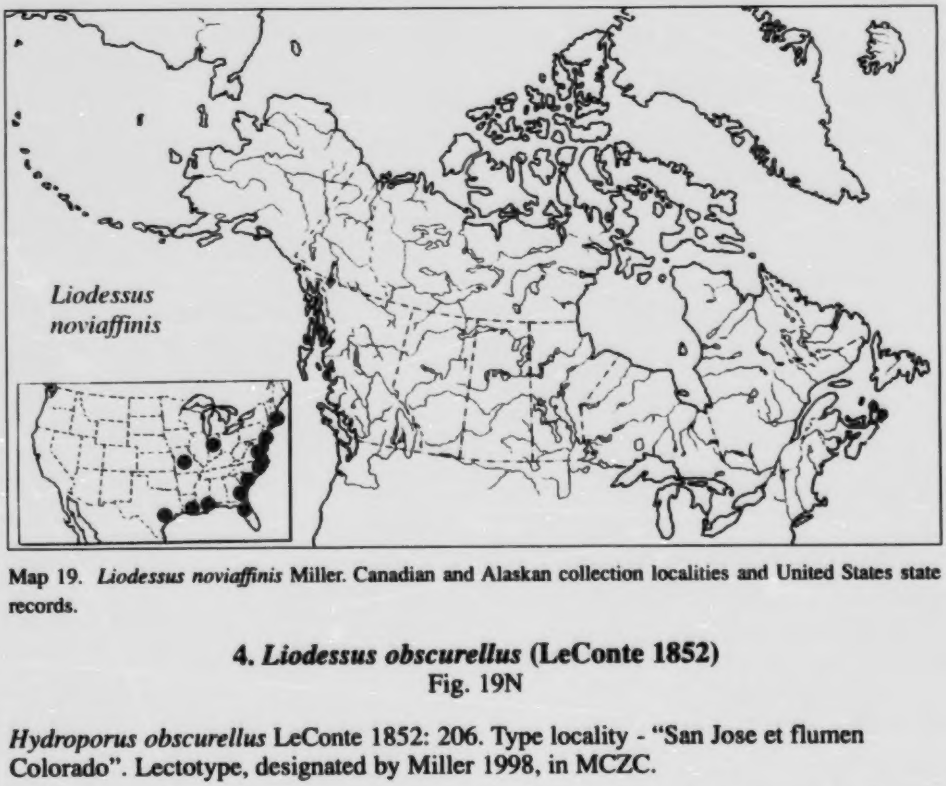
Selected Reference. Miller 1998: 301 – 303.

Description. (After Miller 1998). Length = 1.7 to 2.1 mm; width = 0.8 to 1.1 mm; length: width = 1.85 to 2.16. Tending to be slightly narrower than specimens of *L. affinis* but otherwise the two species are similar in color, sculpture and general structure.

Male genitalia (Fig. 19M) with aedeagus in lateral aspect of more or less even width and strongly curved except nearly straight or slightly upturned apically; in dorsal aspect lateral margins evenly convergent to narrowly rounded apex; parameres relatively broad.

Ecology. Most collection records are from along the Atlantic and Gulf Coasts. Miller (1998) noted that "this species is apparently capable of inhabiting waters of relatively high salinity" so that the species may be somewhat halophilic, occurring in coastal ponds.

Distribution. Map 19. The distribution map is based on records given by Miller (1998). Most collection records are along the Atlantic Coast from Nova Scotia to Florida and along the Gulf Coast to western Texas.



Map 19. *Liodessus noviaffinis* Miller. Canadian and Alaskan collection localities and United States state records.

4. *Liodessus obscurellus* (LeConte 1852)

Fig. 19N

Hydroporus obscurellus LeConte 1852: 206. Type locality - "San Jose et flumen Colorado". Lectotype, designated by Miller 1998, in MCZC.

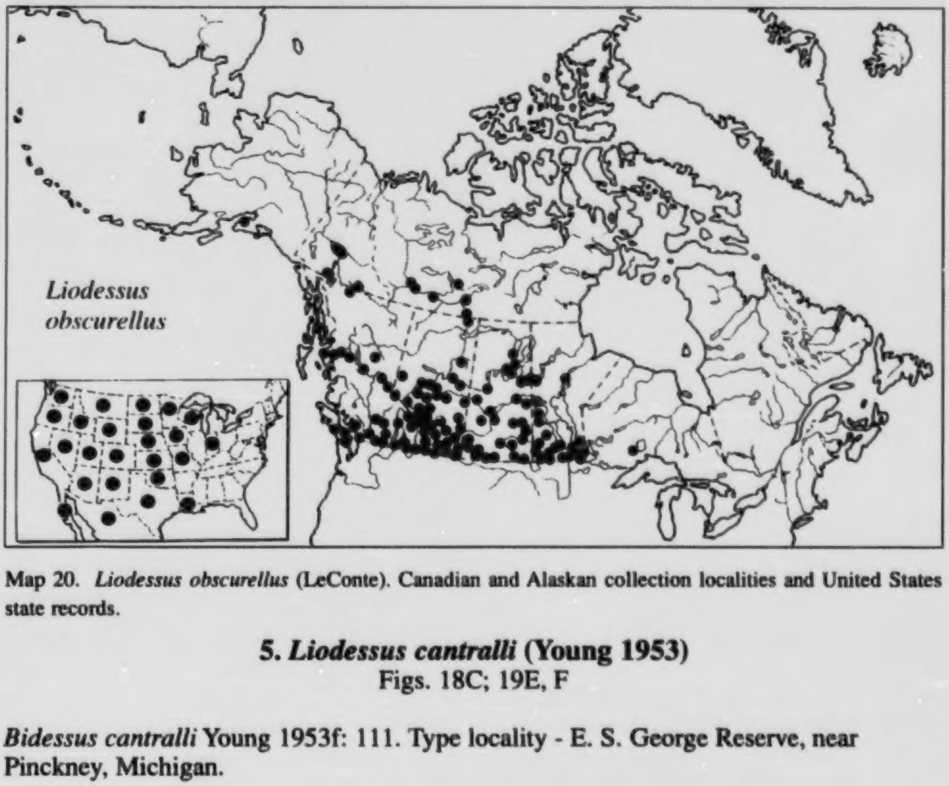
Selected References. Larson 1975: 262 – 263 (as *L. affinis*); Miller 1998: 303 – 309. Previously confused with *L. affinis*.

Description. Length = 1.6 to 2.2 mm; width = 0.7 to 1.2 mm; length: width = 1.8 to 2.07 (2.68 reported by Miller 1998: 284 no doubt in error). Reliably separable from *L. affinis* only on the basis of the aedeagus.

Aedeagus (Fig. 19N) in lateral aspect less arcuate in apical half than in other members of group, shaft distinctly broadened subapically and at widest about twice width of narrowest more proximal portion of shaft; in dorsal aspect slightly to distinctly broadened subapically, lateral margins more or less evidently sinuate towards pointed apex; paramere similar to that of *L. affinis* (Fig. 19J), moderately narrow.

Ecology. Specimens have been collected from a variety of shallow, sun-warmed habitats ranging from prairie ponds to small seepages and the margins of streams of various sizes. Some collections have been from evidently saline waters whereas others are from fresh water. Miller (1998) reports that specimens are often collected in numbers at light and the wide range of habitats may more reflect the dispersal abilities of the insect than its breeding habitat.

Distribution. Map 20. This is the most widely distributed species of the genus in North America. It occurs throughout the Great Plains and Cordilleran regions, from the southern Northwest and Yukon Territories to Texas, California and Mexico.



Map 20. *Liodessus obscurellus* (LeConte). Canadian and Alaskan collection localities and United States state records.

5. *Liodessus cantralli* (Young 1953)

Figs. 18C; 19E, F

Bidessus cantralli Young 1953f: 111. Type locality - E. S. George Reserve, near Pinckney, Michigan.

Selected References. Larson and Roughley 1990: 240; Hilsenhoff 1994; 288 – 289; Miller 1998: 310.

Description. Length = 1.7 to 2.0 mm; width = 0.8 to 1.0 mm; length: width = 1.86 to 2.02. Body (Fig. 18C) dorsally ovate, lateral margin of pronotum and elytron more or less continuous or with only a slight discontinuity.

Body dorsally chestnut brown, slightly paler along margins; elytron without maculations although some specimens have sutural margin slightly darkened. Ventral surface light to dark brown. Legs brown with tibia and tarsi darkened, metatibia pale only on basal third. Antenna with basal two antennomeres yellow, outer antennomeres largely or entirely dark.

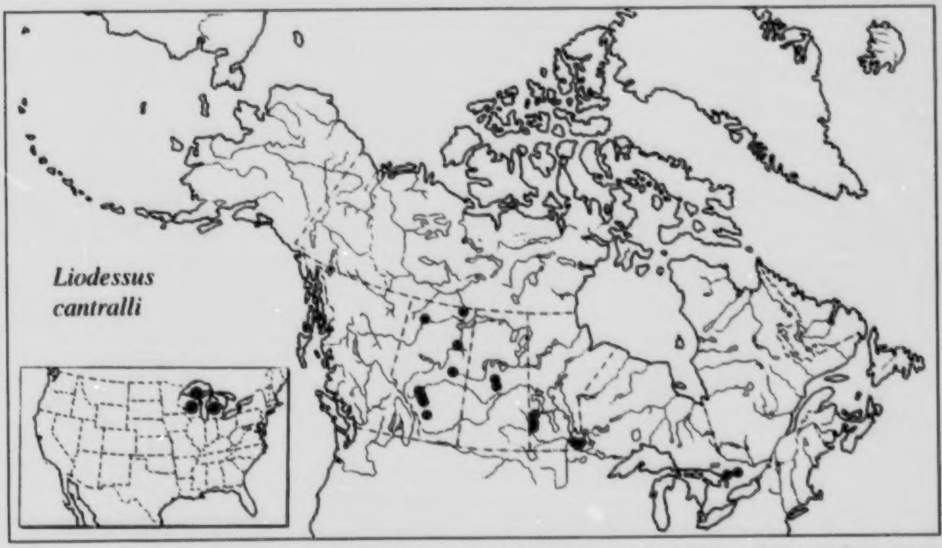
Punctation relatively fine. Pronotum medially with punctures small and relatively widely spaced. Elytron with punctures deeper, separated by two to three times their own diameter except subsuturally a longitudinal series of closely set deeper punctures forms a longitudinal impression on at least basal half, area between impression and suture with punctures small and sparse; setae inconspicuous, shorter than distance between punctures; epipleuron with very small, sparse punctures. Metasternum medially with punctures very small and sparse; metacoxal plate somewhat rugose, with sparse widely separated large punctures. Body highly polished between punctures, microreticulation absent except on sternum 6 which is most strongly reticulate on female.

Pronotum widest across hind angles; basal margin slightly arcuate laterad of plica, posterolateral angle only slightly produced; plica sharply delimited laterally, long, on average about 0.75 length of pronotum measured along same line; lateral bead narrow. Elytron with plica sharply impressed, relatively long, 0.11 to 0.17 length of elytron; epipleuron in lateral aspect hidden behind lateral margin for a short distance behind shoulder. Metacoxal lines diverging anteriorly.

Aedeagus (Fig. 19F) slender, more or less evenly arcuate in lateral aspect, apex with a small dorsal hook.

Ecology. These beetles occur in small pools within the moss mats of fens.

Distribution. Map 21. This species has a limited range in central North America, known from Ontario and Manitoba to Alberta and Michigan.



Map 21. *Liodessus cantralli* (Young). Canadian and Alaskan collection localities and United States state records.

6. *Liodessus abjectus* (Sharp 1882)

Figs. 18A; 19A, B

Bidessus abjectus Sharp 1882*b*: 24. Type locality - Mexico, Oaxaca.

Liodessus youngi Larson and Roughley 1990: 234 – 238. Type locality - Radium Springs, Donna Anna Co., New Mexico. (Synonymy after Miller 1998).

Selected References. Larson and Roughley 1990: 234 – 238; Miller 1998: 309 – 310.

Description. Length = 1.8 to 2.2 mm; width = 0.9 to 1.2 mm; length: width = 1.91 to 2.04. Lateral margin discontinuous in outline between pronotum and elytra but not so strongly as in *L. fuscatus* (Fig. 18A).

Dorsal surface dark reddish brown, except anterior margin of head, lateral margin of pronotum and humeral and apical margins of elytron, yellowish brown to pale reddish brown, gradually darkening mesally. Ventral surface dark brown to piceous. Antennomeres 1 to 4 or 5 mainly yellow, outer antennomeres largely or entirely dark brown. Palpi each with apical palpomere dark, basal palpomeres yellow. Front and middle legs pale brown, hind legs darker, metatibia yellowish basally, at least apical two-thirds distinctly darker brown.

Pronotum conspicuously punctate, punctures small medially on disc, coarser posteriorly, especially along hind margin between posterolateral angle and base of lateral plica. Elytron with coarse punctures separated by about their own diameter, each bearing a fine seta subequal in length to or slightly shorter than distance between punctures; epipleuron finely punctate. Metasternum medially with small but evident punctures. Metacoxal plate slightly rugose but not so coarsely as to obscure rather widely spaced, coarse punctures. Abdomen with sternum 1 coarsely punctate along anterior and posterior margins; sterna 2 to 5 very finely and sparsely punctate; sternum 6 with small deep punctures medioapically. Male with dorsal surface smooth and shiny between punctures; female various, some with entire surface finely microreticulate and somewhat dulled, others with reticulation restricted to apical third of elytra.

Pronotum relatively strongly rounded laterally, with point of maximum width slightly anterad of hind angles; basal margin strongly sinuate, margin laterad of plica evenly arcuate, posterolateral angle evidently produced; lateral plica well developed, two-thirds or more length of pronotum measured along same line, strongly delimited laterally; lateral bead of moderate width, broadest basally and gradually narrowed apically. Elytra elongate-oval in dorsal aspect, moderately narrowed towards base; in lateral profile dorsal margin gently and evenly rounded to apex in apical half; basal plica sharply impressed, about one-half to three-quarters length of pronotal plica; epipleuron in lateral aspect visible to or almost to humeral angle. Metacoxal lines diverging anteriorly.

Aedeagus (Fig. 19B) arcuate in lateral aspect, slightly broadened medially; shaft subparallel and straight for a short distance at apex.

Ecology. Specimens have been collected from among emergent grasses and plant debris in shallow water at the margin of both permanent and temporary ponds.

Distribution. The species is known from South Dakota, Wyoming, Nebraska, Colorado, New Mexico, and southern Mexico. Although there are no Canadian records, it is possible the species occurs in the southern parts of the Prairie Provinces.

7. *Liodessus fuscatus* (Crotch 1873)

Figs. 18B; 19C, D

Hydroporus fuscatus Crotch 1873: 391. Type locality - not restricted, Lake Superior to Florida.

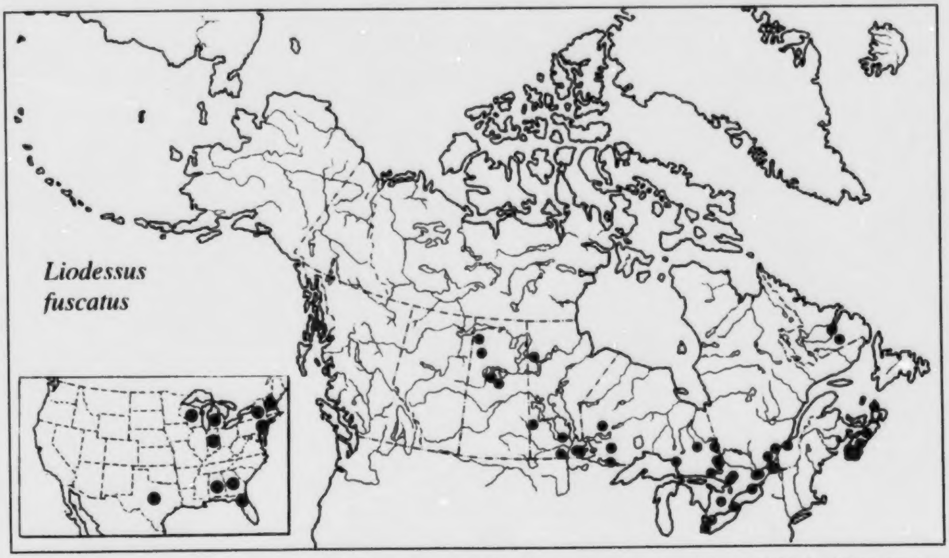
Selected References. Larson and Roughley 1990: 238 – 239; Hilsenhoff 1994: 289; Miller 1998: 310 – 311.

Description. Length = 1.7 to 2.0 mm; width = 0.9 to 1.0 mm; length: width = 1.92 to 2.10. Body (Fig. 18B) in dorsal aspect with lateral margin strongly discontinuous between pronotum and elytra.

Color of body dorsally reddish brown to piceous; elytra maculate or not, maculations consisting of darker brown blotches on mainly yellowish brown elytra, or isolated yellowish brown spots on dark brown or piceous elytra. Ventral surface brown to piceous. Antenna pale basally, antennomeres 3 or 4 to 11 largely or entirely infuscate. Legs brown with tibiae and tarsi darkened, metatibia darkened from basal quarter.

Pronotum with distinct but well separated punctures, most coarsely punctate along hind margin. Elytron coarsely punctate, punctures separated by about 1.5 to 2x their own diameters; each puncture bearing an inconspicuous seta generally shorter than distance between punctures; epipleuron with small but evident punctures. Metasternum with distinct punctures, slightly smaller than those of metacoxa; metacoxa with numerous, coarse punctures. Male with dorsal surface smooth and shiny between punctures; females with variously developed microreticulation which may be largely absent, restricted to apex of elytra, or covering most of body.

Pronotum rounded laterally, point of maximum width clearly anterad of hind angles; basal margin arcuate laterad of plica; posterolateral angle strongly produced; plica sharply defined but relatively short, about one-half to two-thirds length of



Map 22. ***Liodessus fuscatus*** **(Crotch). Canadian and Alaskan collection localities and United States state records.**

pronotum along same line. Elytron with basal plica evident but short; in lateral aspect lateral margin slightly arcuate medially, epipleuron narrowly visible to humeral angle. Metacoxal lines slightly diverging anteriorly.

Aedeagus (Fig. 19D) arcuate in lateral aspect; shaft subparallel and more or less straight medially, apex narrower, otherwise not differentiated.

Ecology. The typical habitat is in the moss mat at the margin of pools and small boggy lakes. The species occurs in both bog and fen habitats.

Distribution. Map 22. This species has a wide distribution in forested areas of eastern North America, from the boreal regions of Labrador to Saskatchewan, south to Florida and Texas.

Genus *Neoclypeodytes* Young 1967

Fig. 20

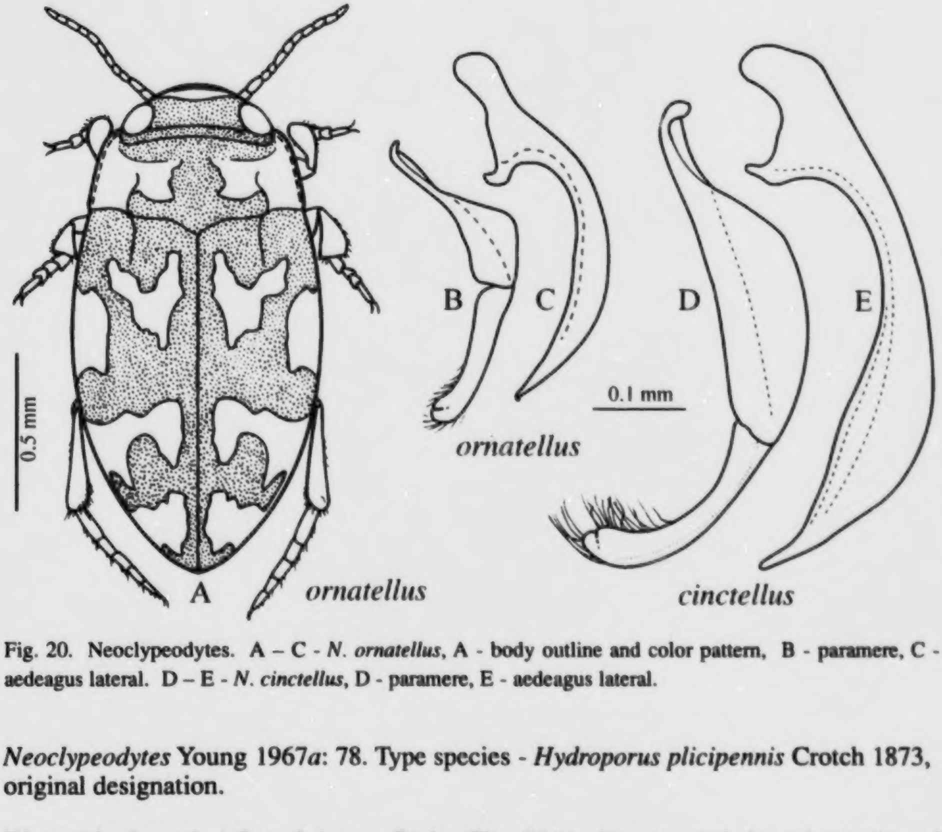


Fig. 20. Neoclypeodytes. A – C - *N. ornatellus*, A - body outline and color pattern, B - paramere, C - aedeagus lateral. D – E - *N. cinctellus*, D - paramere, E - aedeagus lateral.

Neoclypeodytes Young 1967*a*: 78. Type species - *Hydroporus plicipennis* Crotch 1873, original designation.

Diagnosis. Length 1.8 to 2.4 mm. Body (Fig. 20A) elongate-oval, lateral margins of pronotum slightly to distinctly discontinuous in dorsal aspect. Color various; elytron with pale markings either consisting of sublateral spots or forming irregular more or less transverse bands. Metacoxal plates moderately to strongly punctate. Dorsal vestiture inconspicuous.

Head with occipital line between hind margins of eyes; clypeus with anterior margin thickened and raised and limited behind by a distinctly impressed line, at least at middle. Pronotum with basolateral plicae well developed, not connected by a transverse impression or groove. Elytron with basal plica distinct; sutural margin of some specimens thickened and limited laterally by denser punctation which forms an irregular subsutural stria or groove; epipleuron without a carina on shoulder. Metasternum lacking anteriorly converging medial lines. Pro- and mesotarsi pseudotetramerous. Sternum 6 subtriangular in shape, more or less pointed apically and impressed on each side at base.

Paramere (Fig. 20B, D) jointed medially; aedeagus (Fig. 20C, E) simple.

Comments. These insects appear to be closely related to *Liodessus* which they resemble in shape of sternum 6 and male genitalia. In fact, some female specimens have no or little modification of the clypeus and therefore key to *Liodessus*. These beetles usually occur on sand or gravel substrates, often at the margin of small streams or stream-side pools. On the other hand, specimens of *Liodessus* are more typically amongst vegetation or silt and in lentic sites although members of the *L. affinis* complex occur across a wide range of habitats.

This genus is represented by about 20 described species in western North America and Central America. Two species have been collected in western Canada. The species of the genus are poorly understood taxonomically. At least one undescribed species exists in the western United States (Leech and Chandler 1956: 315, as *Bidessus* species) and J. Balfour-Browne segregated many undescribed species from Central America in the BMNH collection. A key to the described species of Canada and the United States is presented below. The key is based on examination of type specimens of most species but as few specimens were examined and our concepts of several of the species are poorly developed, the key is primarily an aid to sorting specimens and not a definitive guide to identification.

Key to species of *Neoclypeodytes* of Canada and the United States

1. Elytron with a more or less distinct longitudinal convex area posterior to basal plica, area between this and sutural margin more or less flat; pronotum in dorsal aspect with lateral margin evenly arcuate and slightly narrowed basally across hind angles and discontinuous in outline with base of elytron; California, Oregon, Arizona 2

1'. Elytron with disc evenly convex and without a longitudinal convex area posterad of basal plica although some specimens with first row of serial punctures more or less distinctly impressed; body in dorsal aspect with lateral margin of pronotum and elytra discontinuous or continuous in outline; Canada to California and Texas 3

2(1). Elytron with inner margin of longitudinal convexity beginning more or less directly behind basal plica, area between sutural margin and longitudinal convexity much more coarsely punctate than lateral portions of disc, with a strongly defined subsutural impression defining raised sutural margin; south and central California, Arizona .... *N. plicipennis* (Crotch 1873)

2'. Elytron with inner margin of longitudinal convexity more mesad on disc than level of basal plica, area mesad to longitudinal convexity not so coarsely punctate, subsutural impression less distinct and sutural margin not evidently raised; northern California, Oregon .... *N. leachi* (Leech 1948*c*)

3(1). Elytron with a well defined subsutural stria formed from closely set, almost contiguous punctures, sutural margin very finely punctate; metacoxal plate with coarse punctures restricted to middle area which is also distinctly rugose, metasternal wings and metasternum medially very finely punctate; small, length = 1.8 to 2.0 mm; British Columbia to California .... *1. N. ornatellus* (Fall)

3'. Elytron with or without a distinct subsutural stria; punctation various, either entire metacoxal plate and metasternum laterally coarsely punctate or punctation of ventral surface fine and sparse; length various, generally larger, 2.0 to 2.4 mm; southwestern United States, California to Texas 4

4(3). Body with punctation fine, metacoxal plate with punctures small and separated by 2 or more times their own diameters, metasternum medially and intralinear space of metacoxa with punctures very small to obsolete; elytron with subapical spot C- or L-shaped .... *N. decoratus* (Fall 1917)

4'. Body more coarsely punctate, metacoxal plate with punctures separated by their own diameters or less, metasternum medially with punctures smaller but distinct; elytron with subapical spot of various shapes 5

5(4). Elytron with subapical pale spot round or oval; California 6

5'. Elytron with subapical spot elongate and curved or much of apex of elytron yellow; Texas to Arizona and Nevada 7

6(5). Elytron with pale spots small and occupying less than half the elytral width, sutural dark area of each elytra between anterior spots about as wide or wider than compound eye; basal plica of pronotum almost straight, equal to or longer than adjacent elytral plica; California .... *N. quadripustulatus* (Fall 1917)

6'. Elytron with pale spots larger, occupying more than half the elytral width of most specimens, sutural dark area of each elytron between anterior spots about one half as wide as a compound eye; basal plica of pronotum sinuate, equal to or shorter than adjacent elytral plica ; California .... *N. pictodes* (Sharp 1882*a*)

7(5). Head yellow to orange and more or less concolorous with palest areas of pronotum; elytron mainly yellow or yellow spots large so that pattern appears one of transverse brown markings on a yellow background; Texas 8

7'. Head brown to piceous and darker than palest portions of pronotum; elytron brown with yellow subbasal, medial and subapical spots, some specimens with subbasal spot prolonged subsuturally and almost or actually contacting subapical spot; Texas to Arizona and Nevada . . . . 2. *N. cinctellus* (LeConte) [the included specimens vary considerably in size, shape and color and it is probable this species is composite]

8(7). Body narrower, length: width = 1.89 to 1.93; pronotum with lateral margin more or less evenly arcuate and even slightly narrowed at hind angles, strongly discontinuous in outline with elytra which in turn are rather broadly and evenly arcuate; elytron with a broad, continuous transverse medial band . . . .*N. discretus* (Sharp 1882*a*)

8'. Body broader, length: width = 1.74 to 1.77; pronotum with lateral margin more or less straight and diverging basally, more or less continuous in outline with elytron or elytron distinctly broadened subbasally; elytron with medial transverse dark band narrow or somewhat broken up into spots or short vittae . *N. obesus* (Sharp 1882*a*)

1. *Neoclypeodytes ornatellus* (Fall 1917)

Fig. 20A – C

Bidessus ornatellus Fall 1917: 167 – 168. Type locality - Portland, Oregon.

Selected References. Hatch 1953: 197.

Description. Length = 1.8 to 2.0 mm; width = 0.9 to 1.0 mm; length: width = 1.92 to 2.02. Body (Fig. 20A) elongate-oval, lateral margins of pronotum and elytron slightly discontinuous in dorsal aspect with elytral margin more strongly arcuate than pronotum basally.

Head dark red to reddish brown, paler anteriorly; antenna with basal 3 or 4 antennomeres pale reddish, outer antennomeres piceous. Pronotum pale reddish anterolaterally, anterior margin, disc anteromedially, posterior margin and lateral bead, piceous. Elytron dark brown to piceous with a pale transverse spot or row of spots subbasally, medially and subapically. Ventral surface dark, legs pale brown or reddish with apex of tibia and tarsi darker.

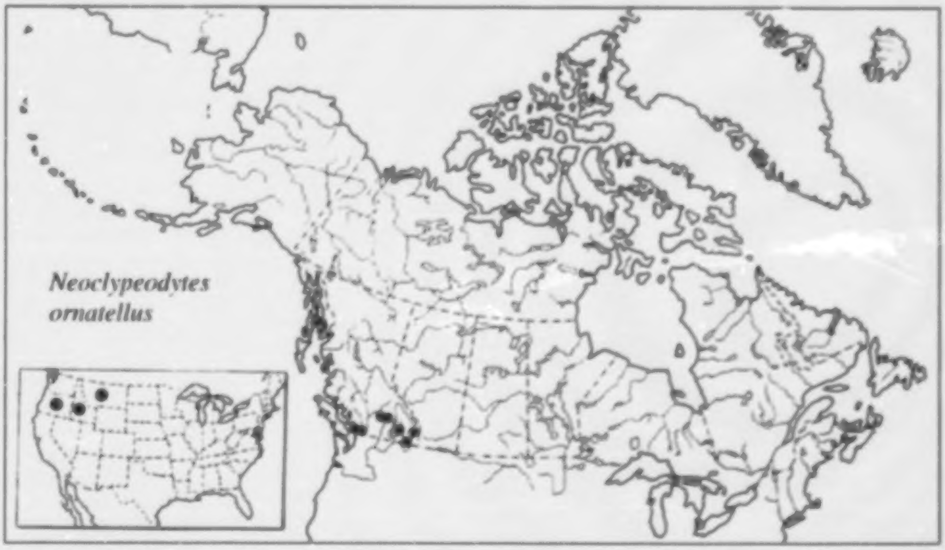
Dorsal surface smooth and shiny with coarse punctures; punctures on elytron separated by their own diameters or more, each with a small inconspicuous seta. Metasternum laterally lacking coarse punctures. Metacoxal plate with coarse punctures restricted to medial area which is also distinctly rugose. Sternum 6 more or less impunctate except for a few small punctures medioapically.

Clypeus of male with anterior margin produced and turned upwards as a well developed rim or carina; female with clypeal rim present but less well developed. Pronotum with plicae slightly longer than half its length, plicae slightly curved and convergent anteriorly. Elytron with plica subequal in length to those of pronotum; with a subsutural row of coarse punctures which form a traceable stria almost to apex, sutural margin mesad to stria slightly inflated and with only small punctures except at apex; disc with first row of serial punctures indistinct, not impressed and elytron without longitudinal convex area.

Male genitalia (Fig. 20B, C) with aedeagus in lateral aspect only moderately broadened subapically.

Ecology. A series of specimens were collected from amongst grasses along a sandy shoreline of Mirror Lake, south of Kaslo British Columbia. Some of these specimens were teneral (August 6, 1964, J. L. Carr).

Distribution. Map 23. This species is known from southern British Columbia, Idaho, Montana and Oregon.



Map 23. *Neoclypeodytes ornatellus* (Fall).Canadian and Alaskan collection localities and United States state records.

2. *Neoclypeodytes cinctellus* (LeConte 1852)

Fig. 20D, E

Hydroporus cinctellus LeConte 1852: 206. Type locality - Gila River, Arizona.

Selected References. Young 1969: 3

Description. (Arizona specimens). Length = 2.2 to 2.4 mm; width = 1.1 to 1.2 mm; length: width = 1.97 to 2.07. Body elongate-oval, pronotum with lateral margin slightly more arcuate than that of base of elytron, body outline slightly discontinuous in dorsal aspect.

Head reddish brown to dark brown posteriorly, paler anteriorly; antenna yellow, outer antennomeres faintly darkened or not. Pronotum yellow to pale brown with anterior and posterior margins and disc medially variously darker brown. Elytron brown with transverse yellow fasciae subbasally, medially and apically, medial and apical fascia joined laterally on most specimens to form a combined C- or L-shaped spot, some specimens with subbasal fascia prolonged posteriorly subsuturally and almost or actually contacting apical pale spot. Ventral surface dark brown, legs yellow to pale brown.

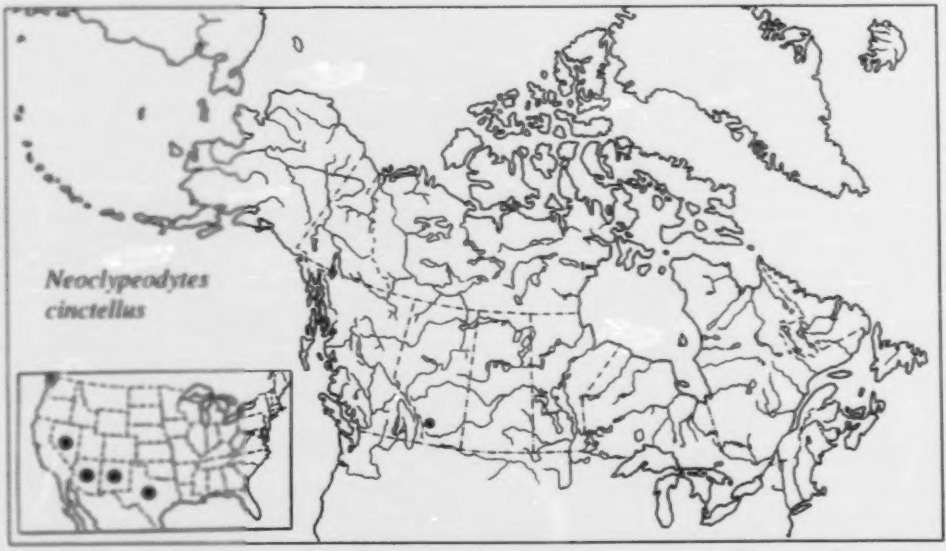
Dorsal surface of males and some females smooth and shiny with coarse punctures, some females densely microreticulate and dull. Elytron with punctures separated by about their own diameters, each with a small, pale seta. Metasternum laterally and almost entire metacoxal plate with large, but separated punctures. Sternum 6 medially with small, deep punctures.

Clypeus with a fine but more or less distinct bead along medial portion of anterior margin (may be faint on some females). Pronotum with plicae well developed, about 0.67 length of pronotum, slightly curved and converging anteriorly. Elytron with basal plica subequal in length to those of pronotum; elytron without a distinct subsutural impression or row of punctures; first row of serial punctures impressed but disc not conspicuously ridged or convex lateral to impression.

Male protarsomeres 1 to 3 distinctly dilated. Sternum 6 with a very small medioapical projection. Aedeagus (Fig. 20E) rather broad medially.

Comments. The above description is based on specimens from southwestern Arizona. Similar specimens have been seen from Texas and southern Nevada but these differ in more extensive pale markings on the elytra and the Nevada specimens are smaller (1.9 to 2.1 mm) with a proportionately larger pronotum so that they may not be conspecific.

Ecology. Label records indicate specimens have been collected from small streams and rain pools. Like other members of the genus they probably occur on bare mineral substrates at the margin of small pools and streams.



Map 24. ***Neoclypeodytes cinctellus*** **(LeConte).Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 24. The known range is western Texas to western Arizona and Nevada. The species is known in Canada from one specimen (Alberta, Moose Mountain, Elbow River, Sept. 5, 1990, J. L. Carr). This specimen was probably wind-borne from a more southerly location.

Genus *Uvarus* Guignot 1939

Fig. 21

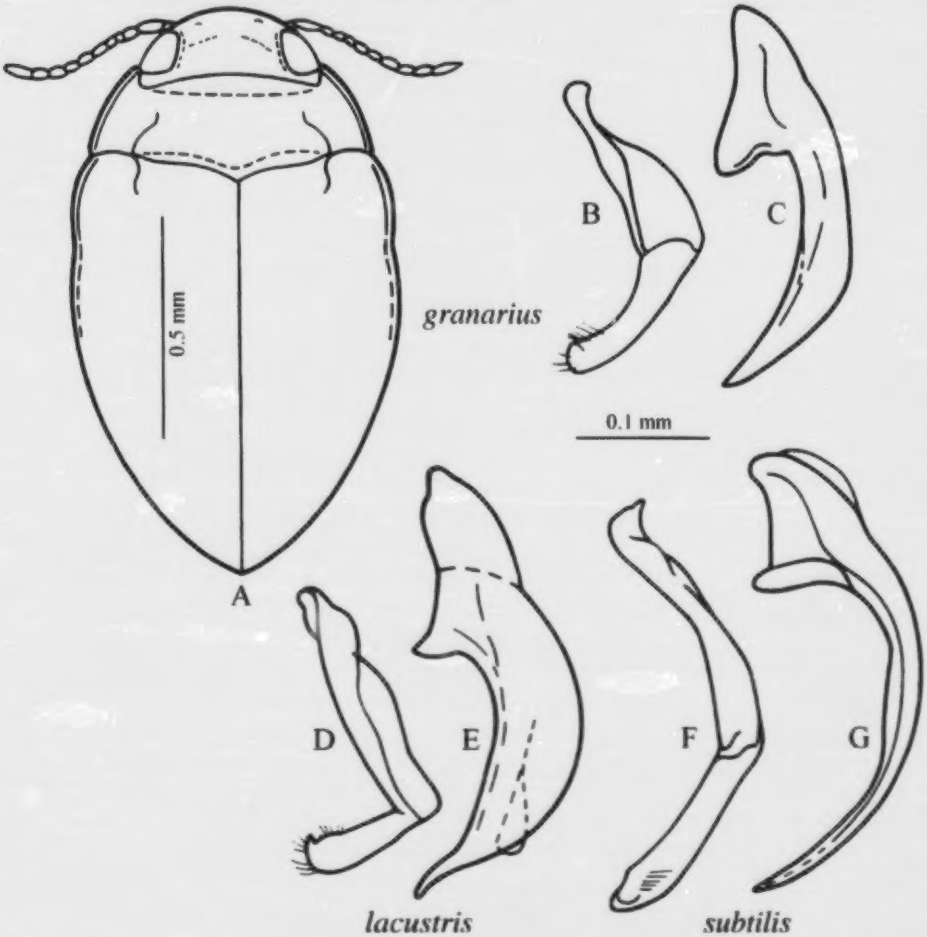


Fig. 21. *Uvarus*. A – C - *U. granarius*, A - body outline, B - paramere, C - aedeagus lateral. D – E - *U. lacustris*, D - paramere, E - aedeagus. F – G - *U. subtilis*, F - paramere, G - aedeagus lateral.

Uvarus Guignot 1939: 53. Type species: *Hydroporus lacustris* Say, by original designation.

Diagnosis. Length = 1.5 to 1.9 mm. Body shape various, broadly oval (Fig. 21A) to elongate- oval. Dorsal vestiture present but generally inconspicuous. Punctation various, metacoxal plate smooth to strongly punctate.

Head lacking occipital line between hind margins of eyes; clypeus simple, lacking an anterior bead but may be thickened and with faint swellings anterior to frontal impressions. Pronotum with basolateral plicae present. Elytron with basal plica present; sutural stria present or not; epipleuron impressed basally and disappearing behind lateral margin of elytron posterad to shoulder in lateral aspect, without a transverse carina on shoulder. Metasternum lacking anteriorly converging medial lines. Pro- and mesotarsi pseudotetramerous. Sternum 6 subtriangular, pointed apically.

Parameres (Fig. 21B, D, F) jointed medially; aedeagus (Fig. 21C, E, G) simple, apically pointed.

Comments. The type species of *Uvarus* is *Hydroporus lacustris* Say. However, Young 1954 pointed out that Say's types are lost and subsequent authors have interpreted the species in different ways, with some authors applying the name to species that do not belong to *Uvarus* as presently defined. Because the identity of *H. lacustris* is uncertain, a neotype should be designated for *H. lacustris* in order to stabilize the nomenclature. As currently defined, the genus occurs in North and Central America (unconfirmed in South America), Africa, Asia and Australia. Biström (1988) revised the African species but concluded that the characteristics on which the genus is based are plesiomorphic and that the genus may be paraphyletic. The genus requires review on a world basis.

Young (1969) listed 16 species of *Uvarus* from the Americas, 10 (nine are recognized as valid here) of which occur in the United States. However, the status of several species is uncertain and the genus requires revision. The North American species can be separated into two distinctive groups, referred to below as the *granarius*- and *lacustris*-groups. Three species are known from southern Canada, but all species which occur in the United States are included in the key to species.

Key to species of *Uvarus* of Canada and United States

1. Body broadly ovate (Fig. 21A), length: width = 1.5 to 1.9; elytron disc behind shoulder strongly longitudinally convex or carinate and/or metasternum with a punctate impression at base of anteromedial process; distribution east of Great Plains and Texas (*U. granarius* group, see Fig. 22 also for separation of species) 2

1'. Body narrower and more elongate, length: width = 1.85 to 2.10; elytron disc behind shoulder evenly convex and without a pronounced longitudinal ridge or carina, metasternum without a punctate impression at base of anteromedial process; widespread (*U. lacustris* group) 6

2(1). Elytron behind shoulder evenly rounded, without a distinct longitudinal carina or convex area; form relatively elongate, length: width = 1.80 to 1.85; metasternum and metacoxal plates finely punctate .... 3. *U. suburbanus* Fall

2'. Elytron behind shoulder with a longitudinal carina or at least a well defined convex ridge; body broader, length: width = 1.52 to 1.86; metasternum and metacoxal plates with punctation various but on most specimens distinct and moderately coarse 3

3 (2). Elytron in dorsal aspect with outer margin of subhumeral carina straight or slightly concave along sharpest part, area below carina impressed and exposing widened epipleural bead; color dark, labial palpus with apical palpomere distinctly infuscate and about as dark as apical palpomere of maxilla . . . . *1. U. granarius* Aubé

3'. Elytron in dorsal aspect with lateral margin of subhumeral carina more or less evenly arcuate, area below carina not impressed and bead of epipleuron not distinctly widened; color various, labial palpus of many specimens not or only lightly infuscate 4

4(3). Body very wide across subhumeral carinae, length: width less than 1.70; elytral carina sharply projecting and acute; area below carina finely and densely punctate; elytral disc densely punctate with punctures tending to form transverse series; New Jersey to Florida . . . . *U. inflatus* Young 1950

4'. Body narrower, length: width greater than 1.70; elytral carina not strongly projecting and more rounded apically, finely punctate; elytron with punctures coarser and well separated; southeastern Canada, eastern United States 5

5(4). Head infuscate, piceous; pronotum yellow with base broadly infuscate; elytra more or less uniformly brownish; Florida . . . . *U. rogersi* Young 1941

5'. Head yellow to pale rufous, not or only faintly infuscate mesad to eye and along hind margin; pronotum yellow, base at most narrowly infuscate between plicae; elytron color various, most specimens with disk reddish brown, vaguely darker at base, along suture and with diffuse postmedial discal clouds; widespread in eastern United States and southern Canada . . . . *2. U. falli* Young

6(1). Pronotum pale yellow-brown, narrowly darker along posterior and apical margins, and disc on some specimens lightly darkened medially; elytron distinctly maculate or not 7

6'. Pronotum with basal third to half broadly dark brown to piceous, apical margin piceous, disc medially darkened and on many specimens connecting dark basal and apical areas; elytron dark brown to piceous with sharply delimited pale spots 8

7(6). Elytron yellow to pale brown, disc without pattern of maculation or with nebulous darker areas medially; length = 1.6 to 1.9 mm; widely distributed in eastern North America . . . . *4. U. lacustris* (Say)

7'. Elytron yellow with darker markings as follows: at base, along sutural margin and transverse bands near middle, subapically and at apex; length = 1.9 to 2.0 mm (3 specimens) Texas . . . . *U. texanus* (Sharp 1882*a*)

8(6). Smaller, length = 1.5 to 1.9 mm; pronotum extensively darkened, most specimens with anterolateral angle and a transverse band behind anterior margin yellow; metacoxal plate smooth, without reticulation; male sternum 6 medioapically with coarse punctures bearing elongate setae . . . . 5. U. subtilis (LeConte)

8'. Larger, length = 1.9 to 2.2 mm; pronotum with more extensive pale maculations, area lateral to plica and submarginal area mainly yellow; metacoxal plate with at least vestiges of microreticulation; male sternum 6 not so conspicuously punctate or setose .... *U. amandus* (LeConte 1852)

The *Uvarus granarius*-group

Species characterized by relatively broad body (length: width = 1.5 to 1.9), elytron more or less broadened behind shoulder and on most specimens with a longitudinal submarginal carina or distinctive convexity behind shoulder; metasternum with an impression at base of anteromedial process. A combination of length and the ratio of length: width (Fig. 22) provides a separation of most species. The species occur in the deciduous forest biome of eastern North America, from southern Canada to Florida and Texas.

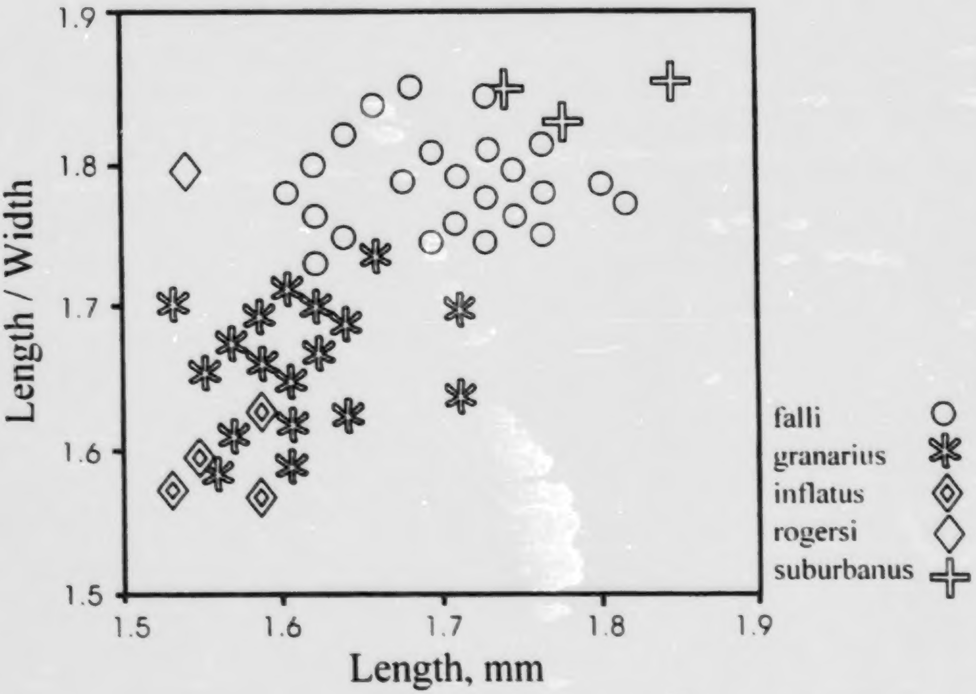


Fig. 22. *Uvarus*. Scatter plot of length to length: width.

1. *Uvarus granarius* (Aubé 1838)

Figs. 21A – C

Hydroporus granarius Aubé 1838*b*: 501. Type locality - North America.

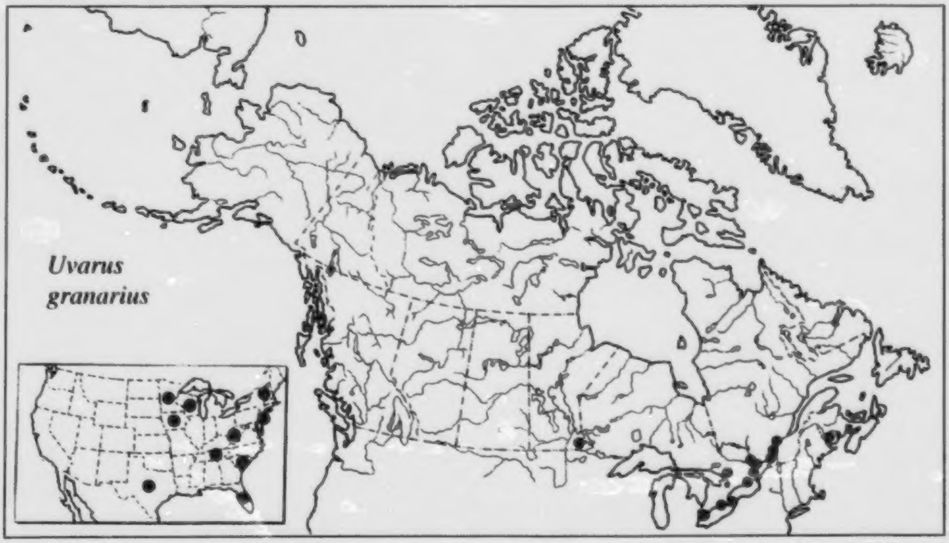
Selected References. Young 1954: 63 – 64; Hilsenhoff 1994: 293.

Description. Length = 1.5 to 1.8 mm; width = 0.9 to 1.0 mm; length: width = 1.59 to 1.74. Body (Fig. 21A) short and broadly oval but lateral margins of elytra more or less parallel basally, depressed dorsally.

Head pale reddish brown, slightly darkened mesad to eyes and along hind margin; antenna yellow basally, antennomeres 3 or 4 to 11 largely infuscate; palpi pale basally, infuscate apically, labial palpus with terminal palpomere darkly infuscate and almost as dark as terminal palpomere of maxillary palpus. Pronotum reddish yellow, hind margin narrowly darkened. Elytron darker, reddish brown, darker at base and along sutural margin, some specimens with vague discal maculation. Ventral surface dark red to reddish brown except head and prosternum reddish yellow. Legs yellow, tibia apically and tarsi darkened.

Head finely reticulate, remainder of body shiny between punctures, without microreticulation. Elytron strongly punctate, punctures well separated and each bearing a seta subequal to or slightly longer than distance between punctures; epipleuron distinctly punctate. Metasternum and metacoxal plate with deep punctures separated by about their own diameters, similar in size and density to those of sterna 1 and 2 and much coarser than those medially on sternum 3.

Clypeus with a pair of tumid areas or faint tubercles on posterior margin anterior to frontal impressions. Pronotum with plicae strongly impressed, sinuate and converging anteriorly, about two-thirds length of pronotum at same level. Elytron plica subequal in length to adjacent pronotal plica; elytron with a sublateral longitudinal ridge or carina beginning at shoulder and running along lateral margin to about middle, apex of carina rather sharp; in dorsal aspect outer margin of carina more or less straight at middle, in lateral aspect carina somewhat arched; area below carina flat or excavate and adjacent bead of epipleuron somewhat broadened. Metasternum with an impression at base of anteromedial process.



Map 25. *Uvarus granarius* (Aubé). Canadian and Alaskan collection localities and United States state records.

Aedeagus (Fig. 21C) in lateral aspect moderately wide medially, apex narrowly pointed.

Comments. This species is a member of a group of eastern North American species characterized by a rather broadly oval shape and by the elytron being longitudinally ridged posterior to the humeral angle. The species can be separated fairly well on the basis of length and shape (length: width) (Fig. 22).

Ecology. Specimens occur in mats of vegetation along shallow, sun-warmed shorelines of small pools. In Manitoba specimens have been collected from the moss mat along the margin of bog ponds. Teneral specimens have been collected 19 July (Michigan) and 6 Sept. (Ontario).

Distribution. Map 25. The species, as here understood, has a range which extends from Quebec to Manitoba and south to Florida and Texas. However, Young (1954) noted variation between northern and southern specimens and suggested that the species may be composite.

2. *Uvarus falli* (Young 1940)

Bidessus falli Young 1940: 30. Type locality - Madison County, Florida.

Selececed references. Young 1941: 31; Young 1954: 65.

Description. Length = 1.6 to 1.8 mm, width = 0.9 to 1.0 mm; length: width = 1.73 to 1.86. Similar to *U. granarius*, larger on average, body more elongate and lateral margin of elytra more arcuate basally.

Head and pronotum mainly yellow to pale rufous; head without infuscation or with only slight darkening along posterior margin; antenna pale basally, outer antennomeres, beginning at antennomere 4 or 5 infuscate apically; maxillary palpus yellow basally, infuscate apically; labial palpus entirely yellow or apical palpomere only faintly infuscate but distinctly paler than apical palpomere of maxillary palpus. Pronotum with hind margin narrowly darkened along hind margin between plicae. Elytron testaceous to pale brown, with sutural margin and basal, medial and subapical areas of disc diffusely darker. Ventral surface pale reddish brown, metathorax darkened.

Dorsal surface shiny except head with light reticulate sculpture; punctation distinct but finer than that of *U. granarius*. Metasternum and metacoxal plates distinctly punctate, punctures subequal in size to those of sterna 1 and 2 and much coarser than those of sterna 3.

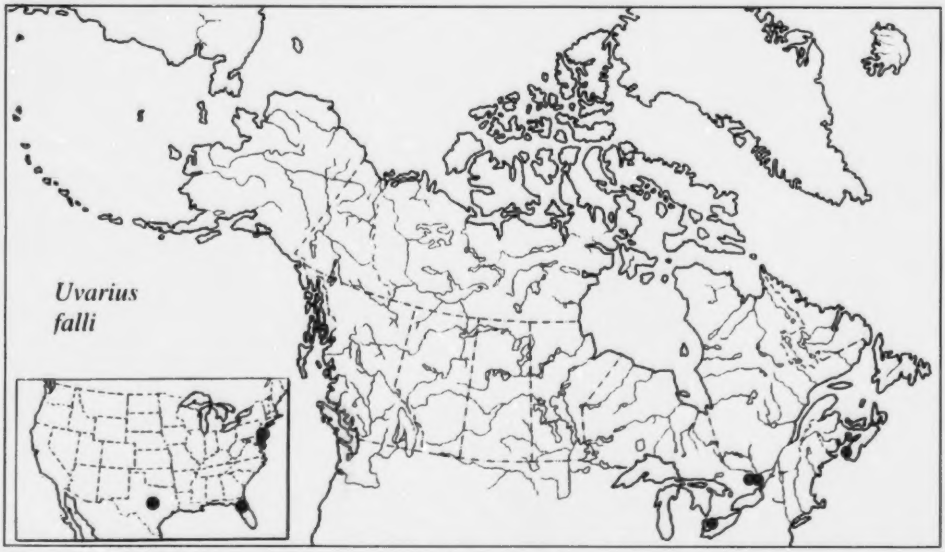
Clypeus convex and with very faint swellings at anteromedial margin of frontal impressions. Pronotum with plicae strongly impressed, sinuate and converging anteriorly, about two-thirds length of pronotum at same level. Elytron plica subequal in length to adjacent pronotal plica Elytron behind shoulder strongly longitudinally convex but not sharply ridged, in dorsal aspect outer margin of ridge evenly arcuate; epipleural bead not distinctly widened below carina. Metasternum with an impression at base of anteromedial process.

Aedeagus in lateral aspect slender, apex with a faint recurved hook.

Comments. *Uvarus falli* (Young1940), described from Florida, appears to belong to the current species but we have not seen the type specimens. Young (1954) stated that *U. falli* differs from *U. granarius* in being of larger average size, less broadly ovate in form and with the carina on the sides of the elytra reduced, exactly the characters that differentiate this species from *U. granarius*.

Ecology. Specimens have been collected from vegetation and debris along the margins of small, sun-warmed ponds.

Distribution. Map 26. This species occurs in eastern Canada from Nova Scotia to Ontario and south to Florida and Texas.



Map 26. *Uvarus falli* (Young). Canadian and Alaskan collection localities and United States state records.

3. *Uvarus suburbanus* (Fall 1917)

Bidessus suburbanus Fall 1917: 169. Type locality - Staten Island, New York. Type - MCZC, (sex not determined), no. 23891, examined.

Selected References. Young 1969: 4; White *et al.* 1985: 358.

Description. Measurements on Maryland specimens are: length = 1.7 to 1.9 mm, width = 0.9 to 1.0 mm; length: width = 1.81 to 1.85. Similar to *U. falli*, differing in narrower body, elytron smoothly rounded behind shoulder without a longitudinal ridge or carina, metasternum and metacoxal plate more finely punctate and aedeagus with apex straight and narrowly rounded.

Head reddish yellow dorsally and ventrally; antenna pale basally, infuscate apically beginning on antennomere 3 or 4; palpi yellow except apical palpomere of maxillary palpus infuscate. Pronotum reddish yellow with hind margin between plicae narrowly piceous. Elytron yellow to pale brown with nebulous to more or less distinct darker areas at base, along suture and postmedially, the post medial area somewhat broken into vague longitudinal spots or blotches. Ventral surface yellow to reddish brown with metathorax and sterna 1 to 5 darker. Legs testaceous.

Body polished, without microreticulation. Head rather finely and sparsely punctate except punctures deeper and denser in frontal impressions and in a transverse band between eyes. Pronotum finely and sparsely punctate, punctures gradually larger towards posteromedial margin; punctures each bearing a short, fine seta. Elytron with small, sparse punctures, largest and densest basally near suture and apically, each puncture bearing a small, pale setae so that body is sparsely setose; epipleuron almost impunctate. Metasternum and metacoxal plate very finely and sparsely punctate, punctures similar in size to those of sternum 3. Sternum 6 with small, dense punctures medioapically.

Clypeus strongly convex, without evident tubercules. Pronotal plicae converging anteriorly, each about two-thirds as long as pronotum measured at same point; elytral plicae about as long as pronotal plicae. Elytron with lateral margin posterior to humeral angle evenly rounded and without evident longitudinal convex ridge or carina. Metasternum with an oval depression at base of anteromedial lobe.

Aedeagus in lateral aspect slender, apex straight and narrowly rounded.

Comments. We recognize this species on the basis of the type specimens from Staten Island, New York, Talbot Co., Maryland (3 specimens, CNC) and specimens from Louisiana. It is very similar to *U. falli* but specimens lack a sublateral carina on the elytron and the metasternum and metacoxal plate are much more finely punctate.

Ecology. The Maryland specimens were collected from a woodland pond. Louisiana specimens were collected in black light traps from 5 to 28 May and 8 August.

Distribution. This species is known from Staten Island, New York, Talbot Co., Maryland, Indiana (White *et al.* 1985) and Louisiana.

The *Uvarus lacustris*-group

Species of relatively elongate shape, elytron not distinctly broadened behind shoulder and without a longitudinal submarginal carina or distinctive convexity behind shoulder; metasternum without an impression at base of anteromedial process. One species occurs in eastern North America and several species occur in the southwestern United States.

4. *Uvarus lacustris* (Say 1823)

Fig. 21D, E

Hydroporus lacustris Say 1823: 103. Type locality - North America.

Selected References. Young 1954: 66 – 67; Hilsenhoff 1994: 293 – 294.

Description. Length = 1.6 to 1.9 mm; width = 0.8 to 1.0 mm; length: width = 1.85 to 2.00. Body elongate-oval, lateral margins of pronotum and elytron forming a continuous curve in dorsal aspect.

Head pale reddish brown anteriorly and medially, darker mesad to eye and posteriorly; palpi pale except apex of maxillary palpus and some specimens also with labial palpus infuscate apically. Pronotum yellow, anterior margin translucent and showing dark head beneath, posterior margin narrowly darkened medially, most specimens with disc slightly darker brown posteromedially. Elytron yellow to pale brown, with diffuse darker areas medially. Ventral surface yellow to reddish brown with meso- and metathoracic sclerites dark brown to piceous. Legs reddish yellow.

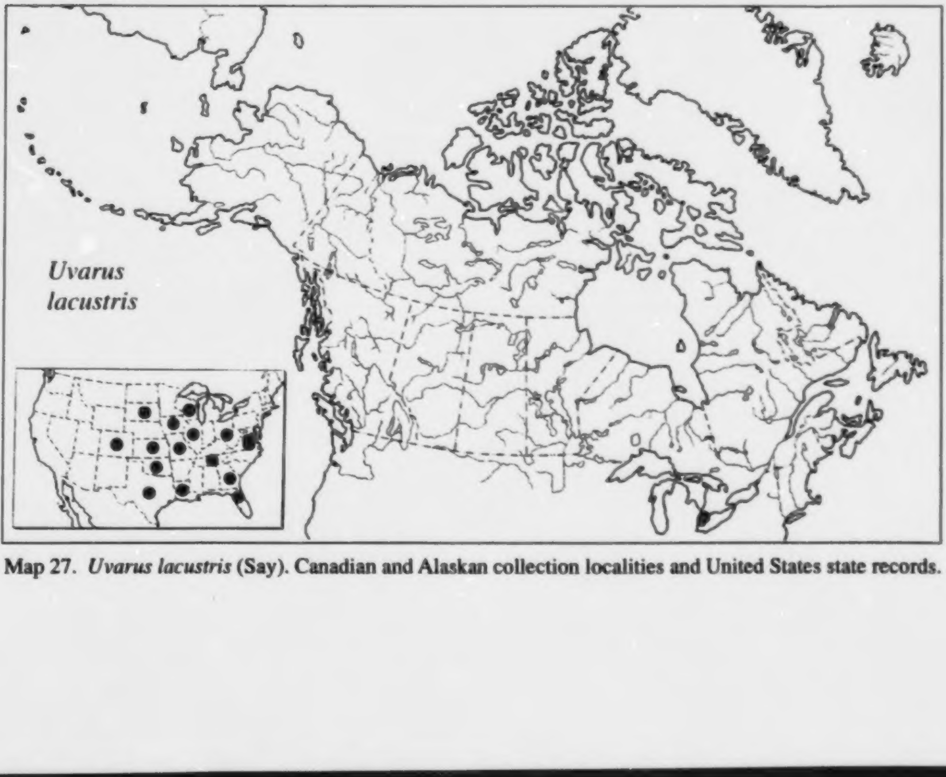
Body without microreticulation. Elytron finely punctate, punctures bearing very fine setae subequal in length to distance between punctures. Metasternum and metacoxal plates very finely and sparsely punctate, each puncture bearing a long, slender seta.

Pronotal and elytral plicae well developed; pronotal plica about two-thirds length of pronotum; elytral plica longer than pronotal plica. Elytron with sutural margin slightly thickened and delimited from disc by an ill defined impression but without a distinct sutural stria; without a sublateral carina or longitudinal convexity behind shoulder. Metasternum with anteromedial process narrow, without an impression at its base.

Aedeagus (Fig. 21E) short and broad, with apex acuminate; in dorsal aspect twisted with apex deflected to right.

Ecology. In the southern United States, this species is often very common in small muddy or clay bottomed pools and in shallow, sun-warmed water along the very edges of larger ponds. Hilsenhoff (1994) recorded specimens from a wide variety of shallow lentic habitats as well as along the margins of streams.

Distribution. Map 27. The species occurs throughout the eastern United States, as far west as Colorado and Texas. Canadian records are from the Niagara Peninsula of southern Ontario.



Map 27. *Uvarus lacustris* (Say). Canadian and Alaskan collection localities and United States state records.

5. *Uvarus subtilis* (LeConte 1852)

Fig. 21F, G

Hydroporus subtilis LeConte 1852: 206. Type locality - California.

Bidessus subplicatus Hatch 1953: 197. Type in USNM. labelled: Echo, Ore./ Aug. 31, 1932/ M. H. Hatch. NEW SYNONYMY.

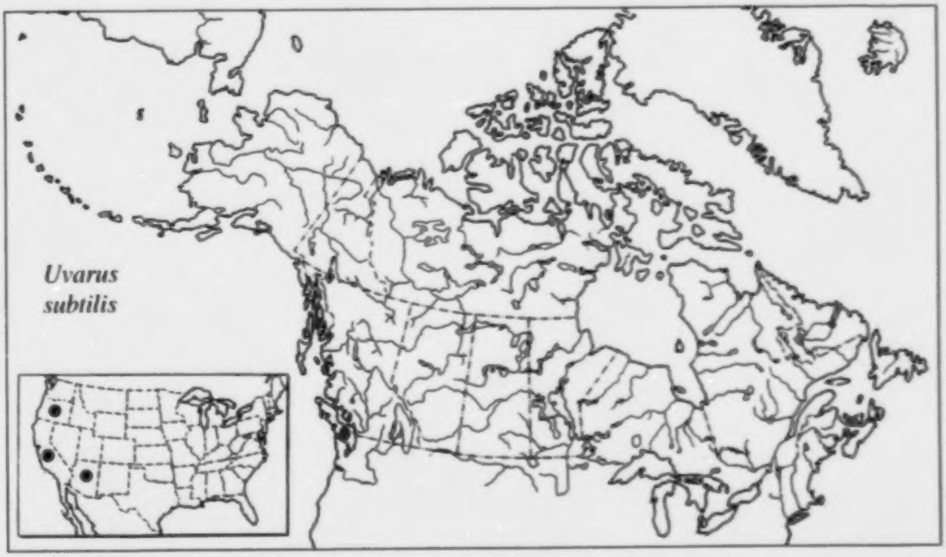
Selected Reference. Hatch 1953:17 (as *Bidessus subplicatus* Hatch).

Description. Length = 1.5 to 1.8 mm; width = 0.8 to 0.9 mm; length: width = 1.87 to 2.00. Body elongate oval; pronotum and elytra with lateral margins continuous.

Body dark brown to piceous except as follows: pronotum with anterolateral portions of disc yellow to pale red, these pale areas connected medially across disc on some specimens; elytron pale laterally, most specimens becoming gradually darker medially but some specimens with pale lateral areas taking form of subbasal, medial and subapical pale spots; metasternum and abdominal sterna mainly piceous to black.

Dorsal surface distinctly and densely punctate, punctures bearing inconspicuous setae which are somewhat longer than distance between punctures. Metacoxal plates smooth to lightly rugose, sparsely and finely punctate, each puncture with a long, fine seta.

Pronotum with basolateral plica one-half to two-thirds length of pronotum. Elytron with basal plica subequal to or longer than that of pronotum: sutural margin inflated and slightly less coarsely punctate than disc, delimited laterally by a broad subsutural longitudinal impression; without a longitudinal sublateral carina behind shoulder. Metasternum lacking impression at base of anteromedial process.



Map 28. *Uvarus subtilis* (LeConte). Canadian and Alaskan collection localities and United States state records.

Aedeagus (Fig. 21G) very slender, evenly arcuate in lateral aspect; paramere elongate and slender.

Comments. The type of *Bidessus subplicatus* Hatch is slightly larger, more densely punctate, and more brightly colored than most specimens of this species but it still falls within the range of variation observed among California specimens.

Ecology. Hatch (1953) thought that the type of *B. subplicatus* was taken along the margin of a stream. This species occurs in gravel, often with filamentous algae, along the margins of slow to rapid, clear streams.

Distribution. Map 28. The range extends from southern British Columbia to California and Arizona.

Tribe Hydroporini Erichson 1837

Figs. 23B – I; 24 – 122

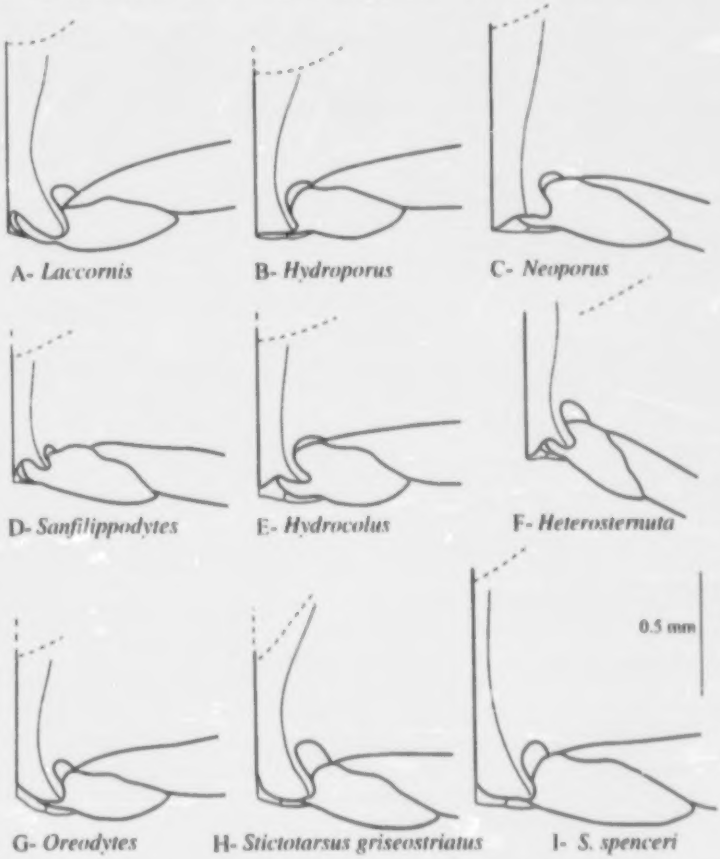
Diagnosis. Minute to moderate size, length = 1.8 to 7.1 mm. Body shape various, subglobose to elongate and parallel-sided. Color and sculpture various. Body glabrous to densely setose.

Clypeus simple on most specimens but with an anterior bead or rim on some. Pronotum lacking basolateral plicae but some specimens with a longitudinal sublateral crease on disc. Scutellum hidden or apex visible behind base of pronotum. Elytron lacking basal plica; apex not produced into a spine but some specimens with lateral margin with an acute subapical tooth; epipleuron with or without a carina at humeral angle. Prosternal process declivous, slightly to strongly descendent from plane of midline of prosternum; process of various shape, elongate and parallel sided to elongate-oval, sharply to bluntly pointed apically. Mesocoxae of most specimens narrowly separated by apex of prosternal process, or contiguous in some specimens. Metacoxal process (Fig. 23B – I) with a well developed lateral lobe which covers base of metatrochanter; hind margin of processes not appressed to abdominal sternum 2, not deeply and sharply emarginate each side of midline but conjointly hind margin of processes of varied shape. Hind leg with or without natatorial setae, but when present setae are on inner margin of metatibia and inner and outer margins of metatarsomeres of both sexes. Pro- and mesotarsi pseudotetramerous, tarsomere 4 small and hidden between lobes of tarsomere 3. Metatarsal claws equal.

Male protarsi various, not to strongly dilated, with ventral vestiture of most specimens containing several to many adhesive setae. Male genitalia with parameres unjointed, in most specimens symmetrical and subequal in length to aedeagus; aedeagus various.

Comments. The classification of this large group of beetles is in a state of flux. It is not at all certain this is a monophyletic tribe. No synapomorphy defines it and almost all tribal characters vary within the tribe. Some authors define the tribe more narrowly, for example Nilsson and Holmen (1995) placed *Hygrotus* in a separate tribe, Hygrotini Portevin.

It has long been recognized that genera such as *Hygrotus* and *Hydroporus sensu lato* are very heterogeneous and should be broken up into a number of more homogeneous, monophyletic genera. Subdivision of *Hydroporus* especially has been hampered by the large number of included species, the great deal of variation exhibited between species in many characters including those used for defining supraspecific groupings, the fact that the group is richly represented in both Old and New Worlds and no one worker has yet developed the global perspective necessary to produce a coherent classification, and different workers differ markedly in the philosophy behind their classification. North Americans have been more conservative in the definition of genera than have European workers. North American conservatism is rooted, in part at least, in the poor knowledge of the fauna, but also reflects dissatisfaction with some of the genera proposed for groups of Palaearctic species, for many of these genera can not be supported through reference to Nearctic species. We do not wish to be innovative in the classification of the Canadian Hydroporini. Rather, we have tried to take a middle of the road position, recognizing as genera groups of species that appear to be clearly monophyletic, and are distinctive enough that they can be recognized in the field by experienced collectors but not necessarily specialists. In this way we hope the genera are real (natural) entities yet remain utilitarian. This approach has meant that some species are not comfortably placed and that the classification may not apply well in other faunas. These shortcomings are noted when they apply to included species.



A- *Laccornis* B- *Hydroporus* C- *Neoporus*

D- *Sanfilippodytes* E- *Hydrocolus* F- *Heterosternuta*

G- *Oreodytes* H- *Stictotarsus griseostriatus* I- *S. spenceri*

Fig. 23. Hydroporinae. Left metacoxal process and leg base, ventral aspect. A - *Laccornis*. B - *Hydroporus*. C - *Neoporus*. D - *Sanfilippodytes*. E - *Hydrocolus*. F - *Heterosternuta*. G - *Oreodytes*. H - *Stictotarsus griseostriatus*. I - *Stictotarsus spenceri*.

Key to genera of Hydroporini of North America

1. Eyes lacking, represented by a vertical line on each side of head; depigmented, subterranean specimens 2

1'. Head with eyes well developed and conspicuous 3

2(1). Length = 3.4 to 3.7 mm; maxillary palpomeres 3 and 4 each with a fan-like brush of elongate setae; metacoxal processes conjointly with hind margin truncate; hind leg with natatorial setae .... *Haedeoporus* Young and Longley 1976 [monotypic, *H. texanus* Young and Longley 1976, Texas]

2'. Length = 1.8 to 2.1 mm; maxillary palpomeres without setal brushes; metacoxal processes conjointly with hind margin produced medially; hind leg without natatorial setae .... *Stygoporus* Larson and LaBonte 1994 [monotypic, *S. oregonensis* Larson and LaBonte 1994, Oregon]

3(1). Epipleuron with a vertical carina at humeral angle (carina may be weak or obsolete on some specimens of H. novemlineatus); body lacking conspicuous vestiture .... *Hygrotus* Stephens, p. 139

3'. Epipleuron lacking a carina on humeral angle; vestiture various, body glabrous to distinctly setose 4

4(3). Metacoxal processes conjointly truncate or excised laterally but medial line extending as far posterad as hind margin of lateral lobes (Fig. 23B – F) 5

4'. Metacoxal processes conjointly with hind margin incised along medial line so that medial line does not extend as far posterad as level of hind margin of lateral lobes (Fig. 23G – I) 11

5(4). Metacoxal processes conjointly with hind margin straight or angularly projecting at middle (Fig. 23B, C) 6

5'. Metacoxal processes with hind margin sinuate, incised on each side of midline (Fig. 23D – F) 7

6(5). Metacoxal processes conjointly with hind margin straight or slightly angulate medially (Fig. 23B); ventral surface of most specimens mainly piceous to black, elytra of most specimens piceous to black but some specimens with variously developed pale maculation .... *Hydroporus* Clairville, p. 270

6'. Metacoxal processes distinctly angulate medially (Fig. 23C); ventral surface of body of most specimens yellow to reddish, elytra of most specimens distinctly maculate ...... *Neoporus* Guignot (in part), p. 241

7(5). Metatrochanter very large, ratio length of metafemur: length of metatrochanter = 1.9 to 2.2 (Fig. 23D) ... *Sanfilippodytes* Franciscolo, p. 202

7'. Metatrochanter smaller, ratio of length of metafemur: metatrochanter = 2.3 to 2.8 8

8(7). Apex of scutellum concealed; elytra maculate, most specimens with elytra dark with subbasal, postmedial and subapical transverse spots (either dark or pale areas may be greatly expanded on some specimens); male protibia without a basoventral emargination 9

8'. Apex of scutellum visible; elytra brown to piceous, without distinct maculations; male protibia with a large basoventral emargination (Fig. 106B) . . . . *Hydrocolus* Roughley and Larson, p. 407

9(8). Male with antennomere 4 (sometimes also 5) enlarged (Fig. 50B); male protarsomere 1 with a basoventral cupule; prosternal process without a basal protuberance . . . . *Lioporeus* Guignot, p. 239

9'. Male antennomere 4 not modified; male protarsomere 1 without a basoventral cupule; prosternal process with a distinct basal protuberance 10

10(9). Aedeagus with apex bifid in dorsal aspect (Fig. 49I, K, M, P); elytron pattern consisting basically of transverse dark maculations not longitudinally interconnected by narrow dark longitudinal projections; male anterior protarsal claw variously modified but not distinctly shorter than posterior . . . . *Heterosternuta* Strand, p. 228

10'. Aedeagus with apex entire; elytron with transverse dark fasciae longitudinally interconnected by 3 or 4 narrow longitudinal extensions; male anterior protarsal claw about one half length of posterior. . . . . *Neoporus* Guignot (in part), p. 241 [*N. shermani* Fall 1917, New York to Kansas and Virginia]

11(4). Ventral surface of body very densely, confluently punctate; metafemur with ventral surface densely punctate; pronotum without a sublateral longitudinal impressed line or crease on each side 12

11'. Ventral surface of body variously punctate but punctures not dense and confluent; metafemur with a single longitudinal row of setae on ventral surface; pronotum with a distinct sublateral longitudinal impressed line or crease on each side (Figs. 115A; 120A) . . . . *Oreodytes* Seidlitz, p. 452

12(11). Elytron with a subapical, lateral tooth (Fig. 113A) . . . . *Nebrioporus* Régimbart, p. 446

12'. Elytron without a subapical, lateral tooth . . . *Stictotarsus* Zimmermann, p. 429

Genus *Hygrotus* Stephens 1828
Figs. 24 – 45

Hygrotus Stephens 1828: 38, 46. Type species - *Dytiscus inaequalis* Fabricius, designated by Curtis 1835.

Coelambus Thomson 1860: 13. Type species - *Dytiscus confluens* Fabricius, designated by Zaitzev 1953.

Diagnosis. Size various, length = 2.1 to 5.6 mm. Body shape various, from subglobose to elongate-oval, lateral outline continuous or not. Color various, many specimens with elytra distinctly maculate with linear vittae or more diffuse blotches. Sculpture various, specimens evidently punctate; microreticulation present or absent; dorsal surface apparently glabrous or with inconspicuous setae.

Clypeus with anterior margin unmodified or margined. Pronotum without a sublateral longitudinal impressed line or crease on each side; lateral bead of moderate width. Elytron in lateral aspect with lateral margin slightly to very strongly ascendant to humeral angle; epipleuron with a transverse carina at humeral angle; lateral margin without a subapical tooth; ventral surface with a large ligula or projection on apical portion of submarginal ridge. Prosternal process contacting metasternum and separating mesocoxae or not. Metacoxal processes with rounded lobes covering bases of trochanters; hind margin of processes conjointly truncate or sinuate and somewhat emarginate each side of middle. Metatrochanter of moderate to large size; metafemur with ventral face sparsely punctate, with a longitudinal medial row of punctures.

Male protarsomeres broadened or not, without distinctive adhesive vestiture beneath; protarsal claws modified or not. Genitalia various, paramere generally triangular or L-shaped, with short setae apically; aedeagus with basal apodemes generally large, apex simple, pointed.

Comments. The North American concept of the genus is broader than that of most European workers who regard *Coelambus* and *Hygrotus* as separate genera, although Nilsson and Holmen (1995) treat these as subgenera. The small, globose species (species 1 to 4 following) belong to *Hygrotus* s. str. whereas the remaining North American species are assignable to *Coelambus*. However, as pointed out by Fall (1919) and others, these groups are not clearly separated for species with various intermediate characters exist. Lacking a carefully worked out phylogeny for the group, a broad generic concept seems most appropriate. The Old World genera *Heroceras* Guignot, *Herophydrus* Sharp, *Hyphoporus* Sharp and *Pseudhydrovatus* Peschet are very similar and with *Hygrotus* have been assigned to the tribe Hygrotini (Nilsson and Holmen 1995).

The North American species have been revised by Anderson (1971, 1976, 1983). Identification of male specimens of most species is easy because they possess characteristically modified protarsi and protarsal claws. Identification of female specimens is much more difficult and generally depends upon the use of characters such as color, punctation and microreticulation, all of which may vary within a species. For example, females of many species are dimorphic for microreticulation, some specimens being densely microreticulate whereas other females are shiny, resembling males. Microreticulate specimens are generally duller in color with less well defined markings and with punctation denser but finer. Larson (1975) showed that female gonocoxae were useful in separating the similar species *H. impressopunctatus* and *H. picatus*. Hilsenhoff (1994) extended this and demonstrated the value of gonocoxae in the recognition of many species. The following key has been constructed so that for many species males, females, and the two female sculptural morphs key out in different places. Size is useful for species recognition but it is not a completely constant character for within many of the larger species the occasional specimen is encountered which is much smaller than average. Also, within the size range of *Hygrotus* species, there is no single measurement of length which is not straddled by one or more species. Where length has been used as a primary character in the following key, species that straddle the critical length have been keyed under each alternative.

All North American species except *H. berneri* Young and Wolfe (1984) from Florida and *H. fraternus* (LeConte 1852) from Arizona, southern California and Mexico, are treated in the key or under discussion of related species.

All members of the genus occur in lentic habitats, where they are usually found in exposed, sun-warmed sites. A number of species occur in, or are even restricted to, saline water, probably because of development of specialized osmoregulatory abilities (Tones 1978, see *H. salinarius* below). Although the genus is represented throughout Canada and Alaska with the exception of the high arctic, species diversity is greatest on the prairies and the warm valleys of southern British Columbia. The species overwinter as adults and breed in spring and early summer. Hilsenhoff (1994) has found evidence that some Wisconsin species may be partly bivoltine.

Key to species of *Hygrotus* of Canada and United States

1. Anterior margin of clypeus with a raised margin or bead (Fig. 44A) OR size small, length = 2.1 to 2.5 mm and shape broad, subglobular (Figs. 24A; 25A), length: width = 1.36 to 1.55 2

1'. Anterior margin of clypeus without a raised bead; length greater than 2.5 mm; most specimens more elongate, length: width = 1.65 to 2.10 8

2(1). Small, length = 2.1 to 3.2 mm; body broad, length: width = 1.48 to 1.80; ventral surface reddish on most specimens; prosternal process contacting metasternum and separating mesocoxae 3

2'. Larger, length = 3.7 to 5.0 mm; body elongate, length: width = 1.89 to 2.04; ventral surface largely black; prosternal process short and not separating mesocoxae or contacting metasternum 7

3(2). Abdominal sterna finely and densely punctate giving surface a granulate appearance; male sternum 6 (Fig. 24B, D) with a medial depression the anterior margin of which bears two slender, backward projecting spines ; length = 2.1 to 2.5 mm 4

3'. Abdominal sterna smooth and shiny between punctures; male sternum 6 not so modified; length = 2.4 to 3.2 mm 5

4(3). Elytron yellow with distinct pattern of a medial and three sublateral piceous spots (spots may be separate or variously fused) (Fig. 24A); elytron with a distinct subhumeral longitudinal ridge; clypeus finely margined .... *1. H. acaroides* (LeConte)

4'. Elytron dark rufous without distinct maculation; elytron without a longitudinal ridge behind shoulder; clypeus not margined .... *2. H. farctus* (LeConte)

5(3). Labial palpus bifid apically in lateral aspect (Fig. 25E); length = 2.4 to 2.7 mm; body more elongate, length: width = 1.65 to 1.77; west of Rocky Mountains .... *3. H. intermedius* (Fall)

5'. Labial palpus with apex at most shallowly emarginate (Fig. 25B); larger, length = 2.8 to 3.2 mm; broader, length: width = 1.58 to 1.70; widespread 6

6(5). Pacific coast, Oregon to Baja California; larger, length = 3.1 to 3.4 mm; male protarsus dilated; elytron with punctures dual, larger punctures shallow . . . . *H. hydropicus* (LeConte 1852)

6'. Transcontinental; length = 2.8 to 3.3 mm; male protarsus not dilated; elytron with punctures more or less uniform in size, deep . . . . *4. H. sayi* Balfour-Browne

7(2). Male protarsal claws (Fig. 44B) long and broadly dorsoventrally flattened; frons with a posteromedial piceous spot; lateral margin of elytron strongly ascendant to humeral angle . . . . *28. H. masculinus* (Crotch)

7'. Male protarsal claws (Fig. 45A) short, arcuate and not laterally dilated; frons of many specimens lacking a posteromedial spot; lateral margin of elytron less strongly ascendant to humeral angle . . . . *29. H. salinarius* (Wallis)

8(1). Ventral surface with at least abdominal sterna 4 to 6 red but many specimens entirely red ventrally or red with metacoxal plates piceous; length = 2.5 to 3.1 mm; body broadly ovate, depressed (length: width = 1.65 to 1.80), most specimens widest before middle and pointed posteriorly (Fig. 26A) 9

8'. Ventral surface darker, predominantly black; length various, body narrower, length: width = 1.73 to 2.10 10

9(8). Elytron with basal punctation dual; surface shiny between punctures on both sexes; metacoxal plates with large punctures; ventral surface entirely reddish . . . . *5. H. sylvanus* (Fall)

9'. Elytron with basal punctation more even, not evidently dual; surface shiny on male or with a silky sheen due to dense microreticulation on female; metacoxal plate with a few large punctures anterolaterally otherwise with small, well separated punctures; most specimens with at least metacoxal plates infuscate . . . . . . *6. H. laccophilinus* (LeConte)

10(8). Sternum 6 modified, either with a posteromedial longitudinal impression, or each basolateral angle with a circular depression followed by a swollen or tumid area (better developed on male than female); elytron with punctation of base dual 11

10'. Sternum 6 without such modifications; elytral punctation various 12

11(10). Sternum 6 with a glabrous longitudinal posteromedial impression; elytral pattern consisting of a diffuse cloud which on some specimens is scarcely evident . . . . *14. H. dissimilis* G. and H.

11'. Sternum 6 with a basolateral impression on each side followed by a swollen or tumid area but without a medial impression; elytron with vittate pattern of maculation but on many specimens vittae broadly fused, at least apically (modification of sternum 6 and dual elytral punctation less evident on reticulate females than on male) .... *24. H. tumidiventris* (Fall)

12(10). Length = 4.3 mm or less 13

12'. Length greater than 4.3 mm 43

13(12). Male with profemur modified, either with ventral margin broadly to narrowly emarginate on apical half or with outer half of anterior face broadly and shallowly impressed and setose; mesofemur and/or mesotibia variously emarginate or impressed on ventral face; aedeagus in lateral aspect with apical quarter very narrow and ligulate, in dorsal aspect apex broad and bluntly rounded [*H. pedalis* group, five species in western United Sates; Leech (1966) and Anderson (1983) provide a more detailed key, illustrations and descriptions] 50

13'. Male pro- and mesofemora not modified; aedeagus in lateral aspect not so narrow apically, in dorsal aspect apex evenly narrowed to apical point; widely distributed 14

14(13). Anterior protarsal claw modified, not of evenly arcuate form of mesotarsal claws (males of some species) 15

14'. Anterior protarsal claw not modified (females and males of some species) 28

15(14). Elytron with microreticulation, covering entire disc or on some specimens partly effaced; ventral surface relatively finely punctate; elytral pattern of narrow more or less separate longitudinal vittae 16

15'. Elytron shiny, without microreticulation; punctation of ventral surface and color various 17

16(15). Head and pronotum reddish yellow, without maculation; pronotum narrow, its sides more or less straight .... *23. H. semivittatus* (Fall)

16'. Head with hind margin darkened, pronotum with a medial spot; pronotum with side clearly arcuate .... *20. H. novemlineatus* (Stephens)

17(15). Anterior protarsal claw elongate (Fig. 38B, C), approximately twice length of posterior claw; elytral pattern vittate; elytral punctation dual with small punctures dense .... *22. H. punctilineatus* (Fall)

17. Anterior protarsal claw subequal to or shorter than posterior claw; maculation and punctation various 18

18(17). Protarsomeres 1 to 3 broadly dilated, tarsomere 2 at least 0.8 times maximum width of protibia 19

18'. Protarsomeres 1 to 3 not or only slightly dilated, tarsomere 2 less than 0.8 times maximum width of protibia 25

19(18). Protarsomere 2 much broader than 1; elytron unicolorous or with dark blotches but without well defined linear vittae 20

19'. Protarsomere 2 subequal to, or only slightly broader than 1; elytral pattern various, some specimens with at least two longitudinal vittae on basal half 23

20(19). Elytron at base with punctation dual consisting of intermixed coarse and fine punctures (not including serial punctures); metepisternum impunctate and smooth or with rugae and a few small punctures along outer margin; widely distributed 21

20'. Elytron with punctures of more or less uniform size on base: metepisternum with outer half punctate; west of Rocky Mountains .... *16. H. obscureplagiatus* (Fall)

21(20). Pronotum piceous with a median transverse rufopiceous band on most specimens; metacoxal plate with coarse more or less evenly spaced punctures over most of its surface; aedeagus slender, longer with apex arcuate (Fig. 23B); west of Rocky Mountains .... *15. H. nigrescens* (Fall)

21'. Pronotum largely rufous to reddish brown, at most anterior and posterior margins piceous; metacoxal plate with punctation various; aedeagus various; widely distributed 22

22(21). Metacoxal plate with punctures much smaller and sparser on mesal half than outer half; aedeagus in lateral aspect with apical half straight or faintly sinuate (Fig. 30C); transcontinental ...... *12. H. compar* (Fall)

22'. Metacoxal plate with coarse punctures more or less evenly distributed over entire surface (except for impressed posteromesal and posterior areas); aedeagus in lateral aspect with apex broadly arcuate ventrally (Fig. 30G, H); west of Rocky Mountains and western Great Plains .... *13. H. bruesi* (Fall)

23(19). Elytron with 3 or 4 usually separate vittae (Fig. 35A); head without infuscate spots; elytron densely punctate, metacoxal plate with punctures coarse, dense and transversely confluent; abdomen coarsely punctate .... *19. H. falli* (Wallis)

23'. Elytron nonvittate, or vittae distinct on base but broadly fused on distal half (Figs. 33A; 34A); punctation not exceptionally dense; punctures separated on metacoxal plate, abdominal sterna finely punctate 24

24(23). Larger, length = 3.8 to 4.7 mm; elytron with punctures on base subequal in size .... *18. H. nubilus* (LeConte)

24'. Length = 3.3 to 4.2 mm; elytron with punctures on base of varied size .... *17. H. patruelis* (LeConte)

25(18). Length = 3.5 to 4.0 mm; head of most specimens largely infuscate with an isolated pale spot between eyes; elytron and metacoxal plate with punctures relatively fine, sparse and evenly distributed .... 9. *H. marklini* (Gyllenhal)

25'. Size various, many specimens smaller, length = 2.9 to 3.9 mm; head of most specimens with pale anteromedial portion of frons contiguous with pale clypeus; elytron with punctures various, of more or less uniform size to strongly irregular 26

26(25). Larger, length = 3.2 to 3.9 mm; elytron with punctation distinctly dual; color reddish, elytron with disc diffusely darkened behind middle; protarsomere 2 distinctly broader than protarsomere 1(Fig. 30D) .... .13. *H. bruesi* (Fall)

26'. Smaller, length = 2.9 to 3.5 mm; elytron with punctures somewhat irregular in size or not; dorsal surface pale brown to rufous with distinct dark maculations on head, pronotum and elytra; protarsi slightly dilated, protarsomeres 1 and 2 subequal in width .... .27

27(26). West of Rocky Mountains .... 11. *H. lutescens* (LeConte)

27'. East of Rocky Mountains .... .10. *H. sellatus* (LeConte)

28(14). Abdomen with microreticulation .... .29

28'. Abdomen lacking microreticulation 40

29(28). Elytron with three or four complete dark vittae, vittae for most part separate throughout length or only shortly connected at base and apex 30

29'. Elytron with pattern various (lacking on some specimens), markings in the form of a broad cloud or if vittate, vittae broadly fused into a single blotch on apical half 33

30(29). Body short and broad, length: width = 1.73 to 1.87 (Fig. 38A); head with base black and contiguous with black spots mesad of each eye; elytron with punctation dual, consisting of sparse large punctures and numerous small punctures (punctation may be obscured by microreticulation .... 22. *H. punctilineatus* (Fall)

30'. Body more elongate, length: width = 1.87 to 2.05; head either entirely pale or more or less infuscate at base and sides; elytron with punctures coarse .... .31

31(30). Pronotum narrow with lateral margins more or less straight (Fig. 39A); head and pronotum entirely pale without maculations; ventral surface with dense but fine punctation; saline waters of Great Plains and Cordilleran regions .... .23. *H. semivittatus* (Fall)

31'. Pronotum broader; lateral margins evidently arcuate; head and pronotum with darker markings; ventral surface with punctation various; arctic and eastern North America .... .32

32(31). Head yellow to reddish, darker towards hind margin on some specimens;punctures dense, metacoxal plates with punctures somewhat irregularly transversely confluent; boreal east of Great Plains .... *19. H. falli* (Wallis)

32'. Head with posterior margin dark and on most specimens frons mesad to each eye distinctly darkened; metacoxal plates with punctures finer and separated; arctic .... *20. H. novemlineatus* (Stephens)

33(29). Small, length = 3.0 to 3.4 mm; elytron distinctly patterned (Fig. 29A), pale on basal third except a small subhumeral spot, apical two-thirds with a large brown or piceous spot contiguous with sutural margin but not touching lateral margins; elytron without microreticulation .... *10. H. sellatus* (LeConte)

33'. Larger, length = 3.3 mm or more; elytron patterned or not; elytron microreticulate or not 34

34(33). Pronotum with disc more or less unicolorous or at least without a distinct medial spot (other than medial fovea darkened); elytron without evident maculations or with only a poorly defined discal cloud 35

34'. Pronotum with a distinct median spot which may be small and isolated or larger and broadly contiguous with darkened hind margins; elytron of most specimens distinctly patterned 39

35(34). Color dark reddish brown to piceous, pronotum with anterior and posterior margins broadly piceous, disk medially with a narrow transverse rufopiceous to rufous band 36

35'. Color reddish to chestnut brown, pronotum entirely rufous or with anterior and posterior margins narrowly piceous 37

36(35). Elytron with punctures or more or less uniform size; metepisternum punctate along anterior margin and on outer half .... *16. H. obscureplagiatus* (Fall)

36'. Elytron with dual punctation although small punctures may be somewhat obscured on microreticulate females; metepisternum impunctate or with a few rugae and small punctures on posteroapical angle .... *15. H. nigrescens* (Fall)

37(35). Metacoxal plate with coarse punctures over entire surface (except depressed areas along posterior margin) although punctures slightly smaller and sparser medially; west of Rocky Mountains .... *13. H. bruesi* (Fall)

37'. Metacoxal plate with punctures much smaller and sparser on mesal half than on outer half; widespread 38

38(37). Pronotum with hind margin piceous, narrowly so laterally, more broadly expanded medially .... *12. H. compar* (Fall)

38'. Pronotum with hind margin not darkened or narrowly darkened medially (margin is transparent and may appear infuscate) .... *13. H. bruesi* (Fall)

39(34). Length = 3.3 to 4.2 mm; head with posterior margin and frons mesad to each eye infuscate; pronotum reddish yellow with a large median brown spot which is contiguous with infuscate posterior border (Fig. 33A); elytron of most specimens densely microreticulate .... *17. H. patruelis* (LeConte)

39'. Length = 3.8 to 4.7 mm; head pale except posterior margin with a small dark spot on some specimens; pronotum pale with a small medial discal spot; elytron with pattern subvittate (Fig. 34A); pronotum and elytra lightly microreticulate or not .... *18. H. nubilus* (LeConte)

40(28). Length = 3.5 to 4.0 mm; head of most specimens darkened with an isolated pale spot on frons between eyes (Fig. 28A); elytron and metacoxal plate with punctures of more or less uniform size and relatively widely separated .... *9. H. marklini* (Gyllenhal)

40'. Length = 2.7 to 3.4 mm; color of head various but most specimens with pale medial area of frons contiguous with pale clypeus; elytron with punctation coarser and more irregular with some irregularity in size of punctures 41

41(40). Length = 2.7 to 3.1 mm; body broad, length: width = 1.74 to 1.85; color yellowish to brownish without distinct markings; elytron at base with punctation dual .... *7. H. turbidus* (LeConte)

41'. Length = 2.9 to 3.4 mm; body narrower, length: width = 1.78 to 1.93; color yellow to reddish brown with distinct darker markings on at least head and elytron; punctation various 42

42(41). Pronotum with a distinct dark oval medial spot; metasternum with submedial series of punctures distinct; intralinear space of metacoxae strongly punctate; elytron at base with intermixed coarse and fine punctures; prosternal process with carina low and on some specimens with ventral margin concave in lateral aspect ..... *8. H. suturalis* (LeConte)

42'. Pronotum more or less suffused with pigment or posterior half broadly darkened without a distinct medial spot; metasternum with punctures of submedial series very fine; metacoxa with intralinear space coarsely punctate only adjacent to lines; elytron at base with punctures more or less equal sized or some specimens with a few coarse punctures present; prosternal process with carina deeper and with ventral margin straight .... *11. H. lutescens* (LeConte)

43(12). Head and pronotum entirely yellow or reddish yellow, without maculation; pronotum narrow, sides nearly straight and only slightly diverging posteriorly, discontinuous in outline with elytra (Fig. 39A) .... *23. H. semivittatus* (Fall)

43'. Head of many specimens with hind margin and frons mesad to each eye infuscate; pronotum with a medial infuscate spot or hind margin infuscate; pronotum with lateral margin rounded 44

44(43). Elytron with serial punctures on base closely set and contiguous, forming more or less distinct longitudinal striae (Figs. 42A; 43A); elytron with punctation dual, consisting of very coarse and much finer punctures (densely microreticulate females with punctures denser, less obviously of dual size and impressed discal striae poorly defined) 45

44'. Elytron basally with serial punctures not contiguous and not forming impressed striae; elytral punctation various but most specimens lacking numerous small punctures 46

45(44). Elytron with vittate pattern either with dark longitudinal markings on a pale background or if elytron is largely brown, with discernable longitudinal pale areas; male abdominal sterna without a trace of microsculpture; female ovipositor with apex short (Fig. 42G) . . . . .26. *H. impressopunctatus* (Schaller)

45'. Elytron brown without either darker or paler longitudinal markings; male abdominal sternum 3 with very faint microreticulation along posteromedial margin; female ovipositor with apex elongate (Fig. 43F) . . . . .27. *H. picatus* (Kirby)

46(44). Length greater than 4.6 mm 47

46'. Length 4.6 mm or less 48

47(46). Male anterior protarsal claw much shorter than posterior and more strongly arcuate, posterior claw large and slightly twisted in dorsal aspect (Fig. 41A); female with entire elytron microreticulate; elytron with punctation of more or less even diameter . . . . .25. *H. unguicularis* (Crotch)

47'. Male anterior protarsal claw subequal in length to posterior claw, with a large ventrobasal tooth (Fig. 37B); posterior claw not modified; female elytron lacking microreticulation on basal quarter to half; elytron with small punctures interspersed with sparse large punctures . . . . 21. *H. infuscatus* (Sharp)

48(46). Metasternal wing and metacoxal plate sparsely and finely punctate medially, laterally with small punctures somewhat obscured by coarse reticulate microsculpture . . . . .20. *H. novemlineatus* (Stephens)

48'. Metasternal wing and metacoxal plate strongly punctate over most of their surface 49

49(48). Body densely and relatively coarsely punctate, metasternal wing and metacoxal plate laterally with punctures dense and more or less laterally contiguous; metasternum medially and sterna 3 to 6 densely and coarsely punctate; elytron with a subhumeral and four discal vittae on basal half of most specimens (Fig. 35A); body humpbacked, point of maximum depth well posterad of middle in lateral aspect . . . .*19. H. falli* (Wallis)

49'. Body more finely punctate; metasternal wing, metacoxa and sterna 1 and 2 with dense but small and generally separated punctures; metasternum medially and abdominal sterna much more finely punctate; elytron on basal half with a short subsutural and a longer medial vitta and one or two elongate sublateral spots (Fig. 34A); body more depressed with maximum depth at about middle . . . .*18. H. nubilus* (LeConte)

50(13). Elytron basally with punctation dual, consisting of dense fine punctures and scattered coarse punctures; male anterior protarsal claw slightly shorter, broader and more arcuate than posterior; male profemur with a subapical excavation on anterior face, ventral surface bluntly toothed subapically with a distal emargination; male mesotibia broad, mesal margin straight; Wyoming . . . .*H. diversipes* Leech 1966: 482 - 486

50'. Elytron with punctures fine, dense, of more or less uniform size; male anterior protarsal claw similar to posterior; male profemur without a distinct ventral tooth; male mesotibia with a sub-basal tooth on mesal face or with an apical mesally direct projection 51

51(50). Male mesotibia with an apical mesally directed projection; male profemur not notched but with outer half of anterior face broadly and shallowly impressed and surface finely granulate; protibia without patch of golden setae on posterior face; mentum with a semicircular median impression; metacoxal plate with an oblique impression adjacent to epipleuron; California . . . .*H. pedalis* (Fall 1901)

51'. Male mesotibia lacking an apical mesally directed projection but with a broad subbasal tooth or projection on mesal face; male profemur shiny, with an impression on anterior face which ends in a setose notch at apical third of ventral edge; protibia with ventral half of posterior face with long golden setae; mentum not impressed medially; metacoxal plate without an oblique impression adjacent to epipleuron . . .52

52(51). Pronotum pale with piceous spot medially on disk; pro- and mesofemora testaceous except apical quarter piceous to black; known only from San Francisco Bay area, California . . . *H. curvipes* (Leech 1938)

52'. Pronotum rufopiceous, pale only near lateral margins; pro- and mesofemora uniformly colored 53

53(52). Male profemur with preapical ventral notch shallow and sparsely setose; male mesotibia with anterior face not obscured by long golden setae in lower apical half; Oregon, Nevada,California . . . .*H. thermarum* (Darlington 1928)

54'. Male profemur with preapical ventral notch large, deep and strongly setose; male mesotibia with apical half of anterior face with long, golden setae; California .... *H. fontinalis* Leech 1966

1. *Hygrotus acaroides* (LeConte 1855)

Fig. 24A – C

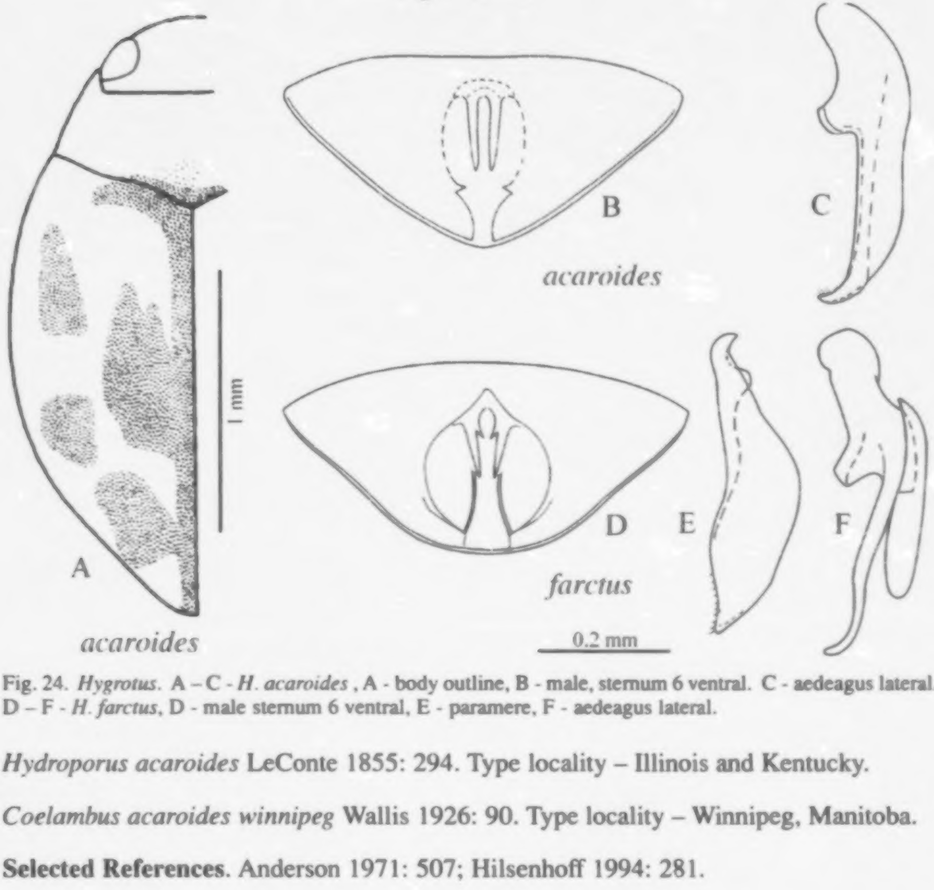


Fig. 24. *Hygrotus*. A – C - *H. acaroides* , A - body outline, B - male, sternum 6 ventral. C - aedeagus lateral. D – F - *H. farctus*, D - male sternum 6 ventral, E - paramere, F - aedeagus lateral.

Hydroporus acaroides LeConte 1855: 294. Type locality – Illinois and Kentucky.

Coelambus acaroides winnipeg Wallis 1926: 90. Type locality – Winnipeg, Manitoba.

Selected References. Anderson 1971: 507; Hilsenhoff 1994: 281.

Description. Length = 2.1 to 2.5 mm; width = 1.3 to 1.6 mm; length: width = 1.48 to 1.57. A small, subglobose species (Fig. 24A).

Head yellow, some specimens with a brown spot mesad to each eye; antenna yellow basally, infuscate apically; palpi yellow. Pronotum yellow to reddish brown, darkest medially. Elytron yellow with base and sutural margin dark brown; disc with a medial and three sublateral brown spots, the medial and the posterior two sublateral spots variously fused on many specimens. Ventral surface red to reddish brown, many specimens with sterna 2 to 5 darkest and contrasting with yellow sternum 6. Legs yellow with tarsi of front and middle legs and femora and tarsi of hind legs, darkened.

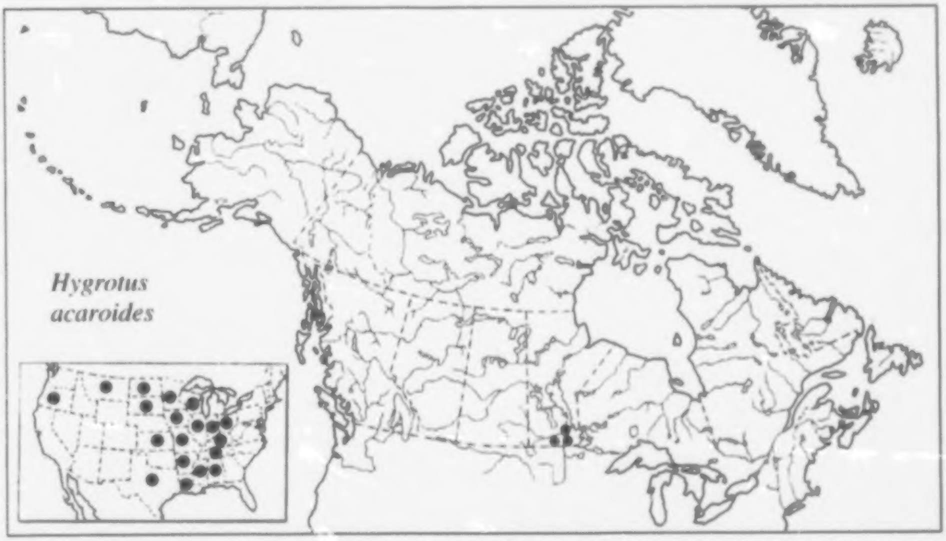
Head and pronotum with numerous small, deep, narrowly separated punctures. Elytron with punctures larger, of more or less uniform size and separated by distances about equal to their own diameters; interspaces with microreticulation but this may be largely effaced on male; epipleuron with punctures separated but indistinct. Metasternal wings and metacoxal plates with very coarse punctures. Abdominal sterna 1 and 2 coarsely punctate, sterna 3 to 6 very finely and densely punctate and appearing densely granular.

Clypeus with a fine anterior margin. Labial palpus with apical palpomere entire apically. Elytron with 1 or 2 low longitudinal ridges behind shoulder, ridges with reduced punctation and microsculpture and shinier than surrounding area. Prosternum with prominence almost right angled in lateral aspect but not produced into a spine between procoxae.

Male protarsomeres slightly dilated; protarsal claws not modified. Sternum 6 (Fig. 24B) with a posteromedial concavity, its anterior margin with a pair of long posteriorly directed spines, each lateral margin with a small ventral spine about middle, and floor of concavity without longitudinal ridges. Aedeagus (Fig. 24C) short and straight except for hooked apex, apex bearing several short spines or setae on ventral surface.

Comments. A similar species, *H. marginipennis* (Blatchley 1912: 330), occurs in Florida. It is characterized by larger size (length = 2.5 to 2.6 mm), darker color, coarser punctation of elytra, sublateral elytral carina less well developed and larger, more robust aedeagus. *Hygrotus acaroides winnipeg* (Wallis) was described as a race. It is characterized by generally more extensive infuscation of the head, antennae and pronotum but is not worthy of separate recognition as color varies within populations of the species.

Ecology. These beetles occur in muddy bottomed ponds or quiet pools on small streams, usually where there are emergent sedges and algae. Hilsenhoff (1994) collected the species from permanent ponds in open areas where the adults overwinter.



Map 29. *Hygrotus acaroides* (LeConte). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 29. This species occurs over much of the Mississippi drainage basis and there is a record of a single specimen from Oregon (Anderson 1971). The only Canadian records are from southern Manitoba.

2. *Hygrotus farctus* (LeConte 1855)
Fig. 24D – F

Hydroporus farctus LeConte 1855: 293 – 4. Type locality - Massachusetts.

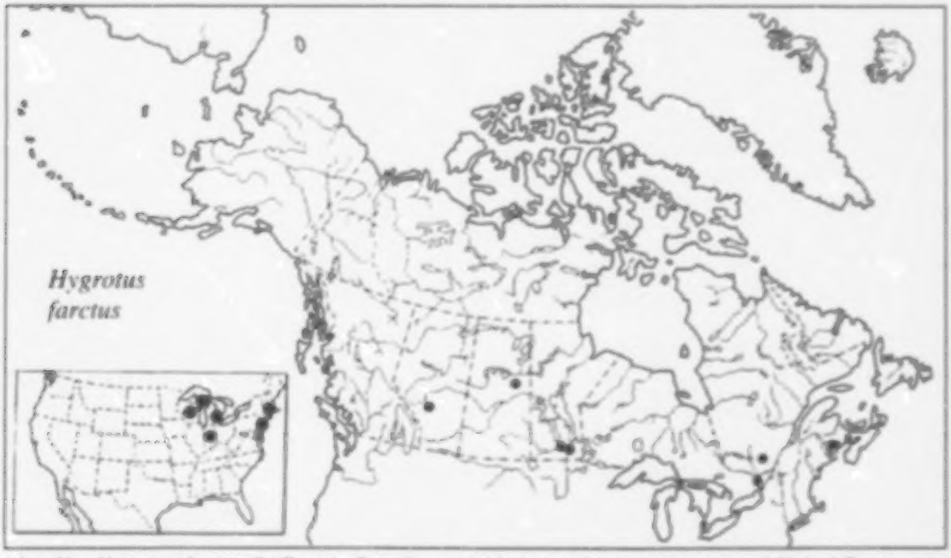
Selected References. Anderson 1971: 508; Larson 1975: 268; Hilsenhoff 1994: 282.

Description. Length = 2.1 to 2.3 mm; width = 1.3 to 1.5 mm; length: width = 1.36 to 1.55. Small, subglobose shape.

Head and pronotum reddish with posterior margin of pronotum narrowly piceous; antenna yellow with apical antennomeres infuscate apically; palpi yellow. Elytron dark reddish brown with base and sutural margin darker. Ventral surface pale reddish-brown to piceous. Legs reddish with tarsi darkened.

Head and pronotum with dense, small, deep punctures. Elytron irregularly punctate with coarse umbilicate punctures, interspaces with numerous small deep punctures; epipleuron densely and confluently punctate. Metasternum and metacoxal plates with large partially confluent punctures. Abdominal sterna finely and densely punctate and appearing granulate.

Clypeus lacking a raised bead on anterior margin. Labial palpus with apical palpomere entire. Elytron lacking a longitudinal carina behind shoulder or with a faint longitudinal convex area. Prosternal process with a prominent spine between procoxae.



Map 30. *Hygrotus farctus* (LeConte). Canadian and Alaskan collection localities and United States state records.

Male protarsus not modified. Sternum 6 (Fig. 24D) with a deep medial impression; impression with two longitudinal posteriorly directed spines arising from front margin; lateral spines absent, floor with a pair of longitudinal, posteriorly diverging carina. Aedeagus (Fig. 24F) in lateral aspect with apex elongate and sinuate.

Ecology. Larson (1975) found the species in small pools of drowned moss in a floating *Drepanocladus* moss mat surrounding a small lake. Specimens have been found in similar habitat in New Brunswick. In New Jersey, specimens have been collected from shallow, flooded vegetation along the margins of a gravel-pit pool. Hilsenhoff (1994) recorded the species from permanent ponds and a marsh. The mature larva was described by Alarie *et al*. (1990).

Distribution. Map 30. The Canadian distribution extends from New Brunswick to Alberta, and in the United States south to New Jersey and Indiana.

3. *Hygrotus intermedius* (Fall 1919)
Fig. 25E – G

Coelambus intermedius Fall 1919: 6–7. Type locality - Alameda Co., California.

Selected Reference. Anderson 1971: 510–512.

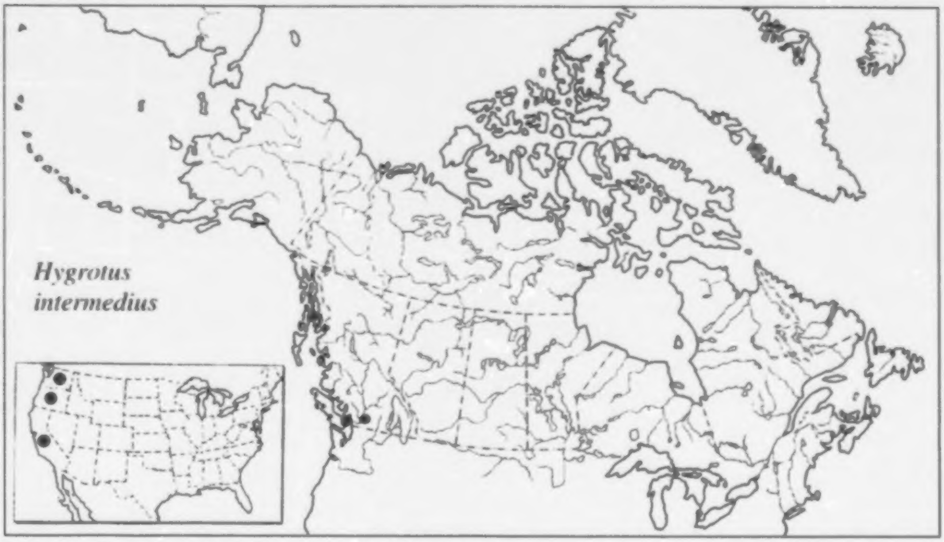
Description. Length = 2.4 to 2.7 mm; width = 1.4 to 1.6 mm; length: width = 1.65 to 1.77. Small, broadly oval.

Head brownish, paler anteriorly on clypeus and anteromedially on frons; antenna pale basally, infuscate apically; palpi pale except some specimens with apical palpomere of maxillary palpus infuscate, apex of labial palpus lightly infuscate. Pronotum yellow with anterior and posterior margins narrowly dark brown to piceous, some specimens with disc medially slightly darkened. Elytron yellow with basal and sutural margins narrowly dark brown to piceous, disc with broad medial and apical brown areas (may be vaguely defined), medial brown markings extended forwards onto base as two or three narrow vittate extensions. Ventral surface of body mainly reddish to reddish-brown.

Elytron with punctation dual on basal half, more uniform apically, larger punctures irregularly spaced basally, more regular apically and separated by a distance about equal to their own diameters. Epipleuron with punctures similar in size and spacing to those of elytral disc. Metasternum and metacoxal plates coarsely and closely punctate, abdominal sterna 1 and 2 coarsely punctate. Body shiny, microreticulation absent except for very faint lines on apical abdominal segments.

Body broadly oval but narrower than in the related *H. sayi*. Clypeus with a raised anterior margin or bead. Labial palpus (Fig. 25E) with apical palpomere strongly bifid apically. Prosternal process with lateral margins broadly inflated basally; basal prominence obsolete; apex contacting metasternum.

Male protarsus and protarsal claws not evidently modified. Sternum 6 not modified. Aedeagus (Fig. 25G) short, broad and poorly sclerotized, paramere narrow (Fig. 25F).



Map 31. *Hygrotus intermedius* (Fall). Canadian and Alaskan collection localities and United States state records.

Ecology. John Carr (*in lit.*) collected specimens on Gabriola Island, British Columbia, from ponds fringed with cattails and sedges and with abundant organic debris and algae.

Distribution. Map 31. In Canada, this species is known only from southwestern British Columbia. The range extends along the Pacific coast to central California.

4. *Hygrotus sayi* J. Balfour-Browne 1944

Fig. 25A – D

Laccophilus punctatus Say 1824: 271. Not Marsham 1802. Type lost. Plesiotype - male, 5 miles NE Pembine, Wisc., USNM (designated by Anderson 1971: 509).

Hygrotus sayi Balfour-Browne 1944: 347. New name for *Laccophilus punctatus* Say 1824: 271. Neotype - 5 mi. NE Pembine, Wisconsin (Anderson 1971).

Selected References. Anderson 1971: 509; Larson 1975: 267; Hilsenhoff 1994: 284 – 285.

Description. Length = 2.8 to 3.2 mm; width = 1.7 to 2.0 mm; length: width = 1.53 to 1.70. Moderately small, subglobose (Fig. 25A).

Head rufous except frons lightly infuscate laterally on many specimens; antenna pale except apical antennomeres infuscate; palpi pale. Pronotum rufous with anterior and posterior borders piceous. Elytron with color various, reddish to dark brown, many specimens with variously developed pattern of usually diffuse maculation which on most strongly marked specimens consists of dark sutural margin, a longitudinal subsutural band, and mediolateral and subapical spots. Ventral surface rufous to rufopiceous, not black. Legs pale reddish.

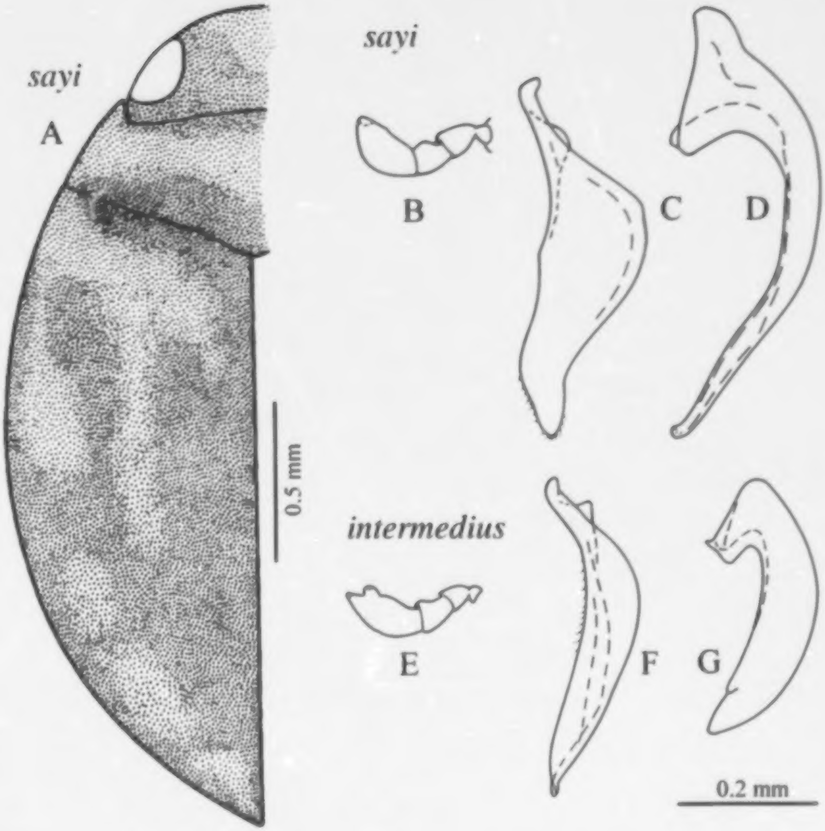


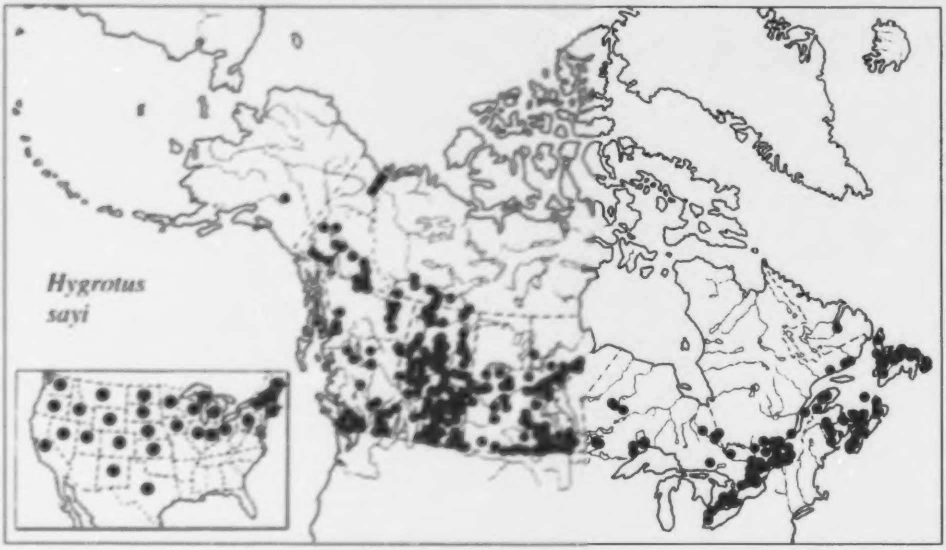
Fig. 25. *Hygrotus*. A – D - *H. sayi*, A - body outline, B - labial palpus, C - paramere, D - aedeagus lateral. E – G - *H. intermedius*, E - labial palpus, F - paramere, G - aedeagus lateral.

Elytron strongly punctate, punctures somewhat varied in size basally and near sutural margin but otherwise of approximately similar coarseness and depth and separated by a distance about equal to their own diameters; epipleuron with distinctly separated punctures. Ventral surface of body coarsely punctate, punctures for most part separated. Body shiny, microreticulation absent from both sexes.

Clypeus with an anterior bead. Labial palpus (Fig. 25B) with apical palpomere pointed to slightly emarginate apically. Elytron without an anterior sublateral ridge posterad to humeral angle. Prosternal process with prominence low, without a spine between procoxae; apex of process contacting metasternum. Abdominal sterna not modified in either sex.

Male protarsus and protarsal claws unmodified, similar to those of female. Aedeagus (Fig. 25D) slender, with a faint medial sinuation and apex very slightly reflexed. Paramere triangular (Fig. 25C).

Comments. *Hygrotus hydropicus* (LeConte 1852) is similar to *H. sayi* but is largely allopatric, occurring in Oregon, California and Baja California. It differs from *H. sayi* in



Map 32. *Hygrotus sayi* Balfour-Browne. Canadian and Alaskan collection localities and United States state records.

that the elytral punctation is dual basally with the large punctures shallower, the male protarsi are dilated and the aedeagus is broad in lateral aspect and resembling that of *H. intermedius*.

Ecology. This species is found in sun-warmed, vegetation rich margins of ponds and slowly flowing streams. It occurs principally in permanent ponds and is seldom found in temporary habitats. The larval stages were described by Alarie *et al.* (1990).

Distribution. Map 32. This species is common throughout most of Canada and the range probably includes the entire area south of the arctic. It also occurs throughout much of the United States except for the southeast and the Pacific coast.

5. *Hygrotus sylvanus* (Fall 1917)

Coelambus sylvanus Fall 1917: 169. Type locality - Peekskill, New York.

Selected references. Anderson 1976: 577; Daussin 1979: 207–208; Hilsenhoff 1994: 283, 285.

Description. Length = 2.5 to 2.9 mm; width 1.3 to 1.4 mm; length: width = 1.80 to 1.90. Size small, body broadly elongate oval, depressed, similar in shape to *H. laccophilinus*.

Color pale reddish to reddish brown on both dorsal and ventral surfaces. Appendages pale except antenna slightly infuscate apically.

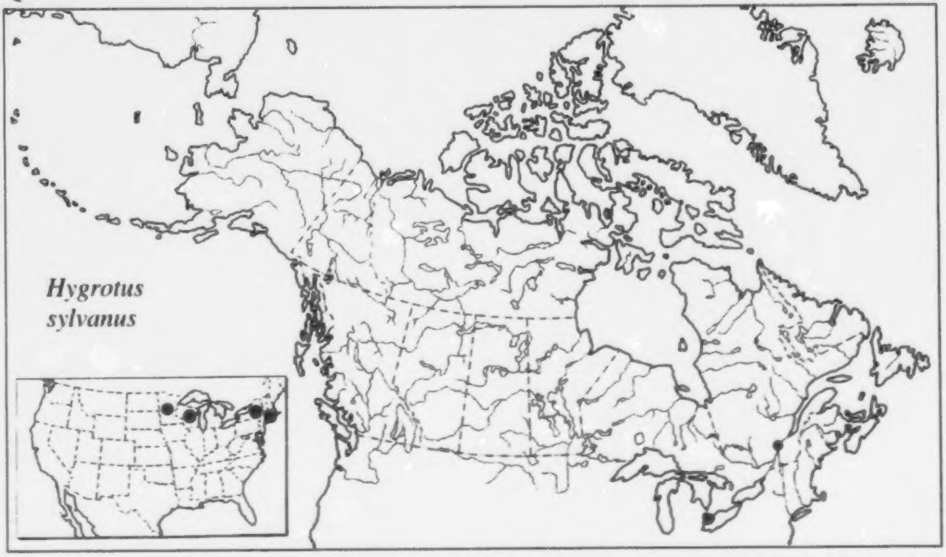
Elytron with intermixed large and small punctures, larger punctures with a tendency to form longitudinal series especially near suture. Metacoxal plates and abdomen basally with large scattered punctures; epipleuron with punctures subequal in size to those of metacoxal plates, closely set. Body with microreticulation present but lightly impressed and faint or effaced especially on base of elytron; sculpture similar on both sexes.

Clypeus lacking an anterior bead. Prosternum with a shallow longitudinal medial groove; prosternal process short but pointed apically, contacting metasternum and separating mesocoxae;

Male with protarsus not modified and similar to female. Aedeagus slender in lateral aspect, evenly arcuate basally, more or less straight towards apex; paramere weakly sclerotized, strap-like, slightly curved and bluntly rounded apically.

Ecology. Daussin (1979) collected specimens from temporary snow-melt pools in a mixed fen, from a small moss-lined pool in a floating sedge mat, and from a marshy area dominated by *Typha* and sedges. Hilsenhoff (1994) found specimens in sedge marshes.

Distribution. Map 33. The distribution is very poorly known with specimens known from New York, Massachusetts, Wisconsin, Minnesota and southern Ontario and Quebec.



Map 33. *Hygrotus sylvanus* (Fall). Canadian and Alaskan collection localities and United States state records.

6. *Hygrotus laccophilinus* (LeConte 1878)
Fig. 26

Hydroporus laccophilinus LeConte 1878*a*: 595. Type locality - Detroit, Michigan.

Selected References. Anderson 1976: 577 – 578; Hilsenhoff 1994: 283.

Description. Length = 2.6 to 3.1 mm; width = 1.5 to 1.8 mm; length: width = 1.67 to 1.80. Body (Fig. 26A) short and broad, broadly rounded in front and more pointed behind, dorsoventrally flattened.

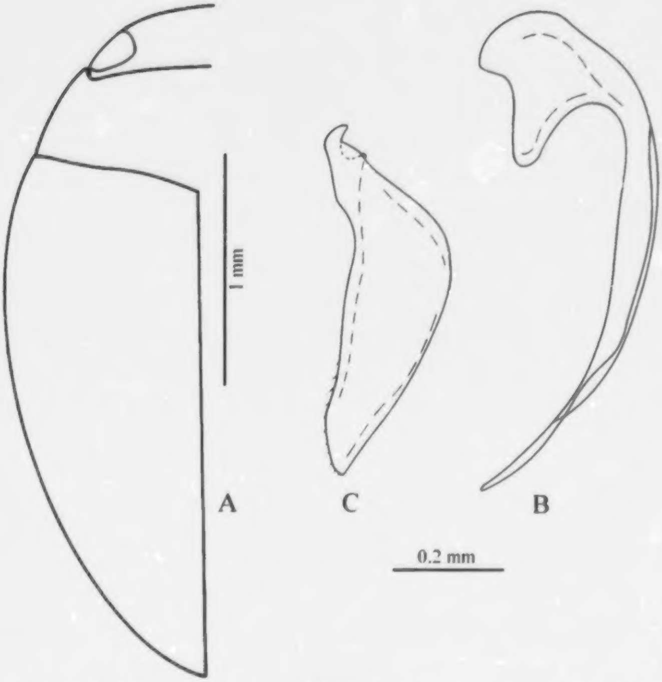


Fig. 26. *H. laccophilinus* (LeConte). A - body outline. B - aedeagus lateral. C - paramere.

Dorsal surface uniformly pale brown to reddish brown. Ventral surface reddish with at least metacoxal plates piceous medially although on many specimens metasternum laterally, metacoxae and sterna 1 to 3 piceous and contrasting with rest of venter which is red. Antennae, palpi and legs entirely pale.

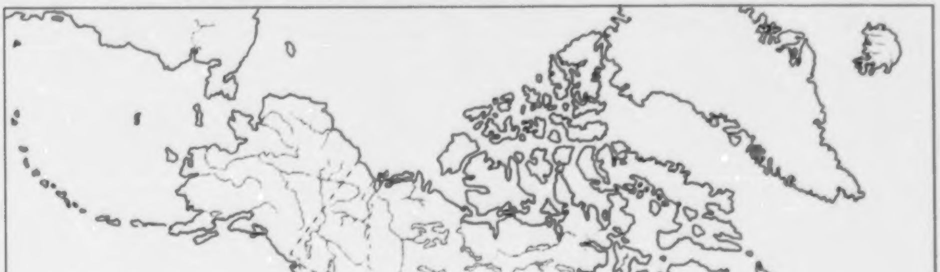
Sculpture sexually dimorphic. Male with dorsum shiny, without reticulate sculpture; elytron with distinct small to moderate punctures, punctation dual basally with intermixed large and small punctures; metasternum coarsely punctate laterally; metacoxal plate adjacent to metasternal wing with a few coarse punctures otherwise punctation fine and sparse. Female elytron with a silky sheen formed by fine dense microreticulation, meshes of sculpture uniform in size and shape, oblong in form; elytron with punctation finer than that of male, punctures slightly longitudinal in shape; metacoxal plates and abdominal sterna strongly microreticulate.

Clypeus without an anterior bead. Antenna slender with outer antennomeres slightly produced on anteroapical angle, antennomere 11 arcuate. Elytron in lateral aspect with lateral margin only slightly sinuate basally. Prosternal process gradually and evenly descendent from plane of prosternum, process contacting metasternum distally. Sternum 6 not modified.

Male protarsomeres 1 to 3 slightly broadened but protarsal claws not modified. Aedeagus (Fig. 26B) slender, apex spine-like and twisted to right.

Ecology. This species has been collected from a variety of small ponds. It appears to be most common among emergent grasses and sedges along the margin of permanent, or at least long lasting ponds. Specimens have been found most frequently in ponds in open country cleared of forest but they have also been collected in woodland ponds, especially beaver ponds. The larval stages were redescribed by Alarie *et al.* (1990).

Distribution. Map 34. This species occurs from Nova Scotia to southwestern Northwest Territories and south to Pennsylvania and Illinois.



Map 34. *Hygrotus laccophilinus* (LeConte). Canadian and Alaskan collection localities and United States state records.

7. *Hygrotus turbidus* (LeConte 1855)

Fig. 27A – C

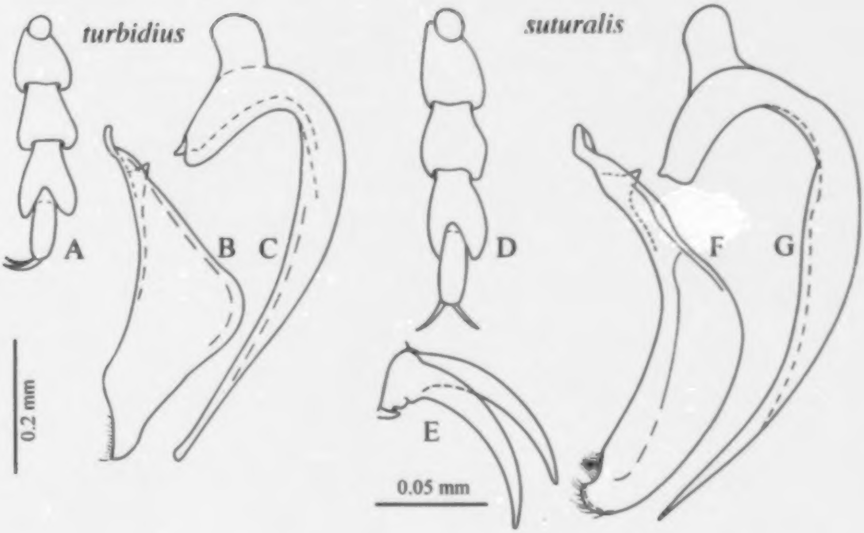


Fig. 27. *Hygrotus*, male. A – C - *H. turbidus*, A - protarsus, B - paramere, C - aedeagus lateral. D –G - *H. suturalis*, D - protarsus, E - protarsal claws anterior, F - paramere, G - aedeagus lateral.

Hydroporus turbidus LeConte 1855: 298. Type locality - Boston, Massachusetts.

Selected References. Larson 1975: 269; Anderson 1976: 57; Hilsenhoff 1994: 285 – 286.

Description. Length = 2.7 to 3.2 mm; width = 1.5 to 1.7 mm; length: width = 1.74 to 1.85. Small, rather broad.

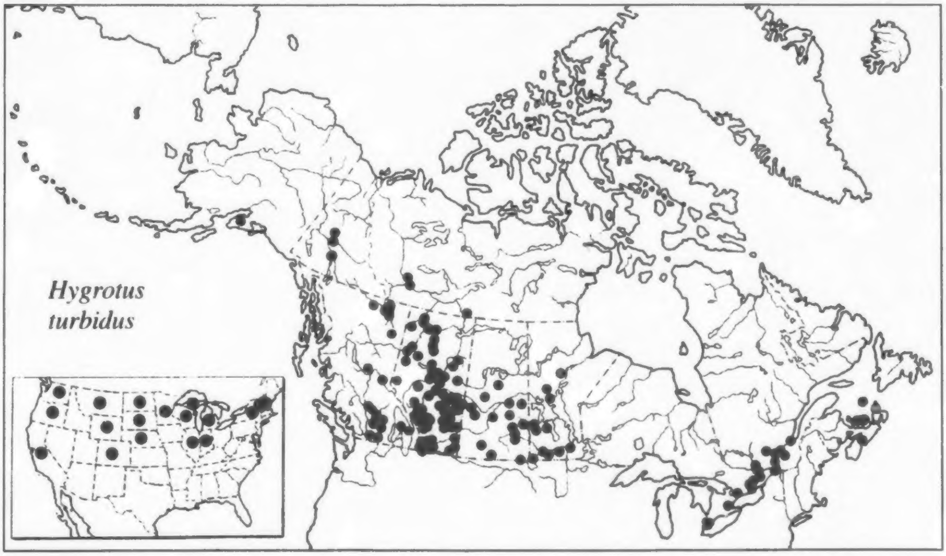
Color reddish yellow to brown. Head with hind margin and frons mesad to each eye slightly darkened; antenna pale basally, outer antennomeres infuscate at least apically; palpi pale except maxillary palpus with terminal palpomere infuscate apically. Pronotum with a diffuse spot on median fovea. Elytron without evident pattern of maculation, sutural margin narrowly darkened, disc dark reddish to brown, paler laterally. Ventral surface of body mainly black. Legs reddish to pale brown.

Elytron with basal punctation dual, with large punctures and smaller punctures of less than one half diameter of larger; punctures more even in size towards apex. Metacoxal plate with separated coarse punctures. Head with isodiametric reticulation, otherwise body smooth and without microreticulation.

Clypeus not margined. Prosternal process elongate and sharply carinate medially, attaining metasternum.

Sexes very similar. Male protarsomeres (Fig. 27A) very slightly broadened; protarsal claws not modified. Aedeagus (Fig. 27C) slender, evenly arcuate in lateral aspect.

Ecology. This species occurs in the vegetation rich shallows of permanent, freshwater ponds.



Map 35. *Hygrotus turbidus* (LeConte). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 35. The range extends from Nova Scotia to British Columbia and from southern Northwest Territories, Yukon and Alaska to southern Illinois, Colorado and California.

8. *Hygrotus suturalis* (LeConte 1850)

Fig. 27D – G

Hydroporus suturalis LeConte 1850: 216. Type locality - Lake Superior. Lectotype - MCZC, male, no. 5995 (designated by Anderson 1983: 182).

Hydroporus ovoideus LeConte 1850: 216. Synonymy proposed by Anderson 1983: 182.

Selected References. Larson 1975: 272; Anderson 1983: 182; Hilsenhoff 1994: 285.

Description. Length = 2.9 to 3.6 mm; width = 1.5 to 1.8 mm; length: width = 1.80 to 1.90. Moderately small, ovate.

Head reddish yellow with hind margin and frons mesad to each eye, brown; antennomeres 5 to 11 and apical palpomeres infuscate. Pronotum yellow to reddish, paler anterolaterally with anterior and posterior margins narrowly piceous and with an oval medial brown to piceous spot which is contiguous with hind margin and on some specimens also front margin. Elytron with ground color testaceous to rufous, with variously developed discal maculation; most specimens with basal third pale except a small subhumeral spot; apical two thirds with a large blotch which on many specimens is extended anteriorly onto basal third as one or two longitudinal projections and on some specimens continuous with subhumeral spot; limits of maculations well defined to obscure. Ventral surface mainly black.

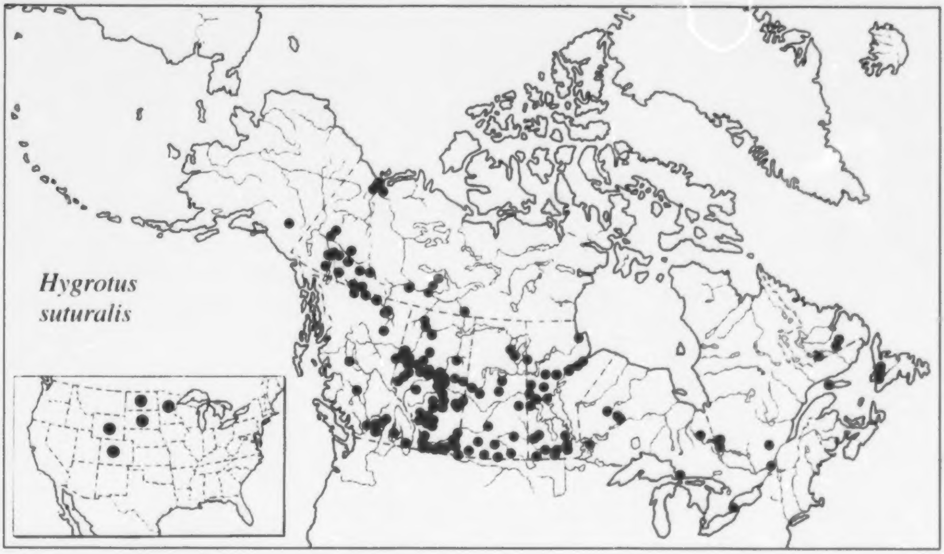
Elytron with punctures on basomedial area irregular in size, with a few large punctures scattered among more numerous smaller punctures; punctures denser and more uniform in size apically. Metasternal wing, metacoxal plate and sterna 1 and 2 with dense moderately coarse punctation; metasternum with submedial longitudinal series of punctures finer than those of metasternal wing but still distinct. Both sexes with elytra, metacoxal plates and abdominal sterna shiny and devoid of microreticulation.

Clypeus without an anterior bead. Prosternal process concave in lateral aspect, with a low median carina; contacting metasternum.

Male protarsus (Fig. 27D) only very slightly dilated; protarsal claws (Fig. 27E) not modified. Aedeagus (Fig. 27G) slender and arcuate in lateral aspect, slightly broadened ventrally near middle and more or less straight in apical quarter.

Ecology. In the Great Plains region the species occurs most frequently in warm, weedy freshwater ponds which are permanent or long lasting. The usual habitat in Labrador is among emergent sedges or rushes growing on sand or gravel along protected lake shores.

Distribution. Map 36. This species occurs throughout the boreal region, from Newfoundland to Alaska and from the Mackenzie Delta to Colorado. The species is common in the prairie parkland zone and is also found sparingly in fescue grassland ponds.



Map 36. *Hygrotus suturalis* (LeConte). Canadian and Alaskan collection localities and United States state records.

9. *Hygrotus marklini* (Gyllenhal 1813)

Fig. 28A – E

Hyphydrus marklini Gyllenhal 1813: 689. Type not examined.

Coelambus canadensis Fall 1919: 11. Type locality - Winnipeg, Manitoba. Synonymy proposed by Nilsson and Holmen 1995: 36.

Coelambus virgo Fall 1919: 12, 13. Type locality - Virgin River, Utah.

Selected References. Larson 1975: 270; Anderson 1983: 183; Hilsenhoff 1994: 283; Nilsson and Holmen 1995: 36 – 37.

Description. Length = 3.1 to 4.0 mm; width = 1.7 to 2.1 mm; length: width = 1.84 to 2.00. Body (Fig. 28A) elongate-oval.

Head relatively dark, brown to piceous with an isolated yellow spot on frons between eyes which is separated from clypeus by an infuscate area; antennomeres 5 to 11 infuscate; palpi yellow basally, apical palpomere of each palpus infuscate. Pronotum with anterior portion pale yellow-brown, disc diffusely darkened on posterior half, grey-brown to piceous. Elytron pale yellow-brown basally and laterally, disc diffusely darker brown with limits of darkened area vague on most specimens. Ventral surface mainly black.

Elytron with punctation fine, discal punctures of more or less uniform size and smaller than serial punctures. Metacoxal plates with punctures relatively small and widely separated. Sternum 6 medially with area adjacent to apical bead impunctate. Elytra, metacoxal plates and abdominal sterna smooth and shiny between punctures, devoid of microsculpture in both sexes.

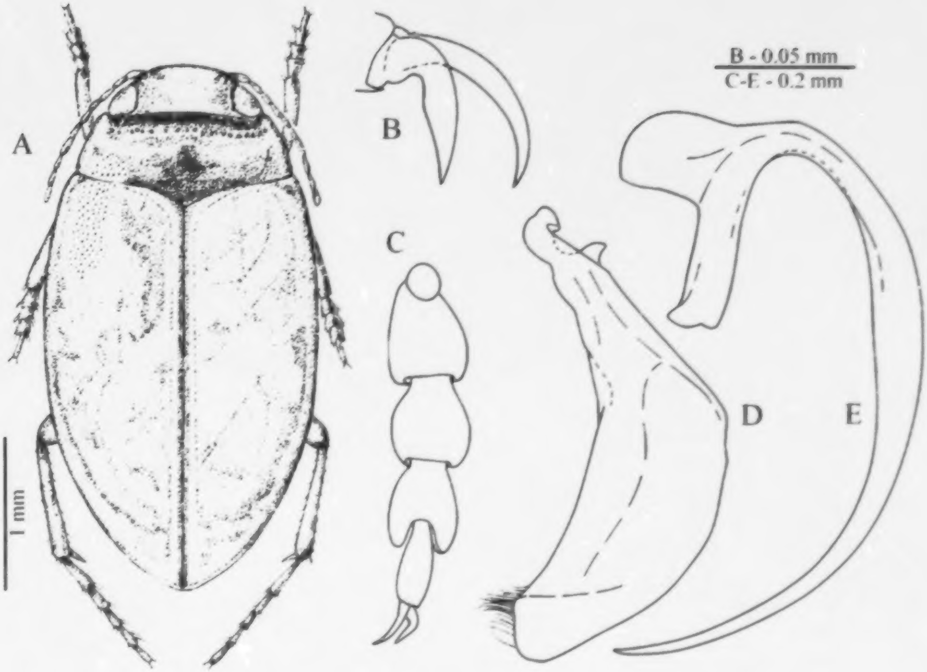


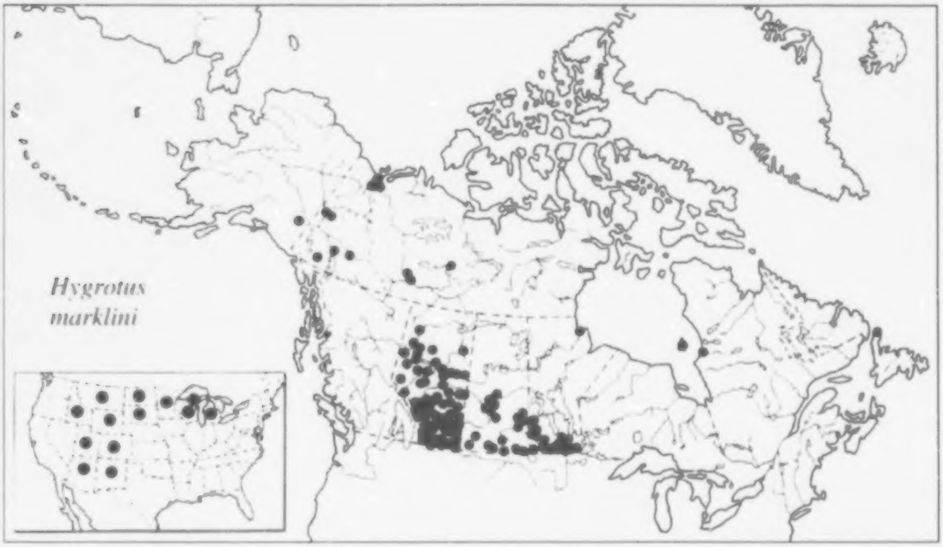
Fig. 28. *Hygrotus marklini*, male. A - habitus. B - protarsal claws anterior. C - protarsus. D - paramere. E - aedeagus lateral.

Clypeus lacking an anterior bead. Prosternal process contacting metasternum. Abdominal sternum 6 not modified.

Male protarsomeres (Fig. 28C)1 to 3 only slightly dilated, tarsomeres 1 and 2 subequal in width and slightly wider than tarsomere 3; anterior protarsal claw (Fig. 28B) slightly shorter than posterior claw, slightly broader and more abruptly bent basally. Aedeagus (Fig. 28E) elongate, narrow and evenly curved in lateral aspect.

Ecology. Larson (1975) recorded the species as occurring among emergent vegetation and plant debris along the margins of small, often temporary, ponds. The species is not truly halophilic but is sometimes found in distinctly saline waters. In Newfoundland, specimens have been found only in small pools on limestone barrens where pH and conductivity are relatively high.

Distribution. Map 37. The species has a Holarctic distribution. Within the Nearctic region the species is most abundant on the northern Great Plains but the range extends from northern Newfoundland to Alaska and south in the west to New Mexico and Arizona. Nilsson and Holmen (1995) record it from Fennoscandia and central Europe to northern China and the Magadan area in the Palaearctic region.


Hygrotus marklini

Map 37. *Hygrotus marklini* (Gyllenhal). Canadian and Alaskan collection localities and United States state records.

10. *Hygrotus sellatus* (LeConte 1866)

Fig. 29

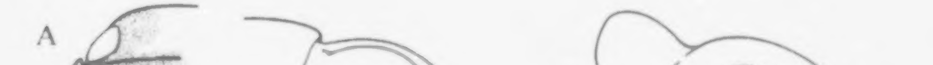

A
B
C
D
E
1 mm
B 0.05 mm
C - D 0.2 mm

Fig. 29. *Hygrotus sellatus*, male. A - body outline. B - male protarsal claws anterior. C - protarsus. D - paramere. E - aedeagus lateral.

Hydroporus sellatus LeConte 1866: 365 – 366. Type locality - "Dacota".

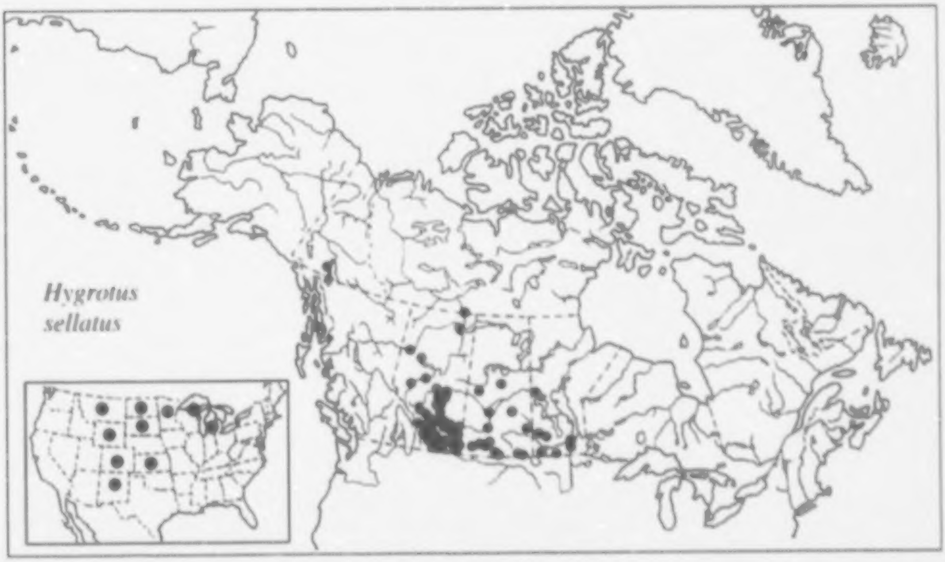
Selected References. Larson 1975: 272; Anderson 1983: 182 – 183.

Description. Length = 2.8 to 3.5 mm; width = 1.6 to 1.8 mm; length: width = 1.78 to 1.93. Small, ovate (Fig. 29A).

Head dark brown to piceous with frons medially rufotestaceous to rufous (on some specimens pale area also includes most of clypeus); antenna and palpi pale basally, infuscate apically. Pronotum mainly brown to piceous except for anterolateral pale areas on disc (some specimens with these pale areas broadened and extended mesally. Elytron testaceous with sutural margin piceous, basal third of disc immaculate except for a brown or piceous subhumeral spot; apical two thirds with a large brown or piceous spot which is contiguous with sutural margin but separated from lateral margin by distinct pale areas; these maculations distinctly limited. Ventral surface mainly black. Legs testaceous to brown, most specimens with femora basally and tarsi infuscate.

Elytron with punctures of moderate size, subequal, separated by less than their own diameters basally and denser apically; fine punctures present along sutural margin. Metasternal wing and metacoxal plate coarsely punctate, metasternum with submedial longitudinal punctures fine. Metacoxa with intralinear space finely punctate except for coarser punctures just mesad to each line. Sternum 6 medioapically with area adjacent to bead narrowly impunctate or with a few irregularly scattered punctures. Male lacking microreticulation. Female lacking microreticulation dorsally, ventrally with fine lines on abdominal sterna and some individuals with obsolete lines on metacoxal plates.

Clypeus lacking anterior bead. Prosternal process elongate and contacting metasternum, medial carina well elevated and appearing straight in lateral aspect.



Map 38. *Hygrotus sellatus* (LeConte). Canadian and Alaskan collection localities and United States state records.

Male protarsus (Fig. 29C) slightly dilated; anterior protarsal claw (Fig. 29B) modified, broadened and strongly arcuate basally. Aedeagus (Fig. 29E) slender and more or less evenly arcuate throughout length; paramere (Fig. 29D) short and broad.

Comments. See *H. lutescens* for comments on its recognition.

Ecology. These insects occur in fresh to moderately saline water of permanent and longer lasting, temporary ponds. They occur both among aquatic vegetation as well as on sparsely vegetated clay substrates.

Distribution. Map 38. This is primarily a species of the Great Plains. The range extends from western Ontario (Anderson 1983) and Michigan to Alberta and north to the southern Northwest and Yukon Territories. The southern limits are Kansas and New Mexico (state locality only, CNC).

11. *Hygrotus lutescens* (LeConte 1852)

Hydroporus lutescens LeConte 1852: 208 – 209. Type locality - San Francisco, California. Lectotype - MCZC, male, no. 4, designated by Anderson 1983.

Hydroporus medialis LeConte 1852: 209. Synonymy proposed by Anderson 1983: 183.

Hygrotus impressifrons Motschulsky 1859: 165. Synonymy proposed by Anderson 1983: 183.

Hydroporus infacetus Clark 1862: 180. Synonymy proposed by Anderson 1983: 183.

Selected Reference. Anderson 1983: 183.

Description. Length = 3.0 to 3.7 mm, width = 1.6 to 1.9; length: width = 1.80 to 1.95. Very similar to *H. sellatus* and possibly conspecific.

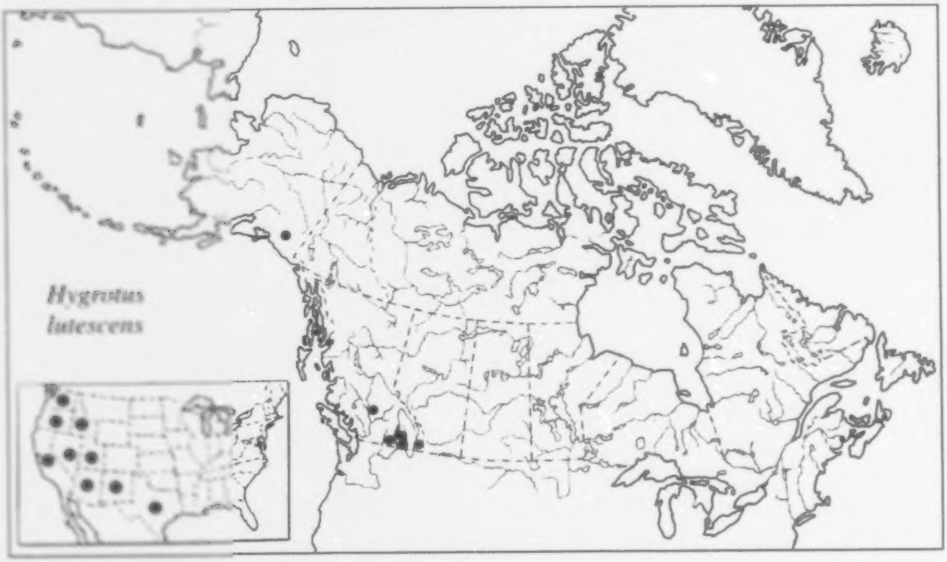
Color similar to *H. sellatus* except pronotum paler with a defined posteromedial brown spot, basal half not broadly infuscate as in *H. sellatus*. Elytron with dark maculations extending more anterad, almost or actually attaining base and contiguous with subhumeral spot. Sculpture and punctation similar except female *H. lutescens* lack microreticulation on abdomen. Male protarsi and genitalia similar to that of *H. sellatus*.

Comments. The only reliable character for separation *H. lutescens* and *H. sellatus* is the sculpture of the female abdominal sterna. The color differences described above are average patterns and specimens of *H. lutescens* vary in the extent of pronotal infuscation and some have a free subhumeral elytral spot. Range is the best guide to identification: *H. sellatus* occurs east of the Rocky Mountains and in the north whereas *H. lutescens* is a western species, occurring west of the Rocky Mountains.

A similar species, *H. sharpi* (Van den Branden 1885: 42), occurs in coastal California. *Hygrotus sharpi* is slightly larger (length = 3.8 to 4.4 mm), body more parallel-sided, elytra more extensively darkened, and the paramere has the basal process more elongate and apical part more evenly narrowed (Anderson 1983). *Hygrotus artus* Fall 1919: 9, known only from the holotype, Mono Co., California, may be a synonym of *H. sharpi*.

Ecology. Specimens have been collected from a pond with patchy, sparse vegetation and black organic muck near Osoyoos, British Columbia (CARR). The species is not a strong halophile but its distribution in drier, central British Columbia suggests it occurs in ponds of some mineral enrichment.

Distribution. Map 39. This species occurs west of the Rocky Mountains, from southern British Columbia to California and western Texas. The Alaskan record indicated on the map is from Anderson (1983), we have not seen Alaskan specimens.



Map 39. *Hygrotus lutescens* (LeConte). Canadian and Alaskan collection localities and United States state records.

12. *Hygrotus compar* (Fall 1919)

Fig. 30A – C

Coelambus compar Fall 1919: 8. Type locality - Tyngsboro, Massachusetts.

Selected References. Larson 1975: 269; Anderson 1976: 583; Hilsenhoff 1994: 281.

Description. Length = 3.5 to 4.1 mm; width = 1.7 to 2.1 mm; length: width = 1.84 to 1.93.

Color dorsally reddish to reddish brown, without distinct maculation. Head dark red to brown with anterior margin paler; antenna and palpi pale basally, infuscate apically. Pronotum red to reddish brown with anterior and posterior margins piceous. Elytron uniformly reddish brown to brown with sutural margin narrowly piceous, disc without maculations or vaguely darkened medially and posteriorly. Ventral surface mainly black.

Elytron with punctures of obviously unequal sizes, consisting of large punctures and more numerous intermixed smaller punctures, disparity in size of punctures greatest on base and becoming less evident distally. Metasternal wing, metacoxal plate and

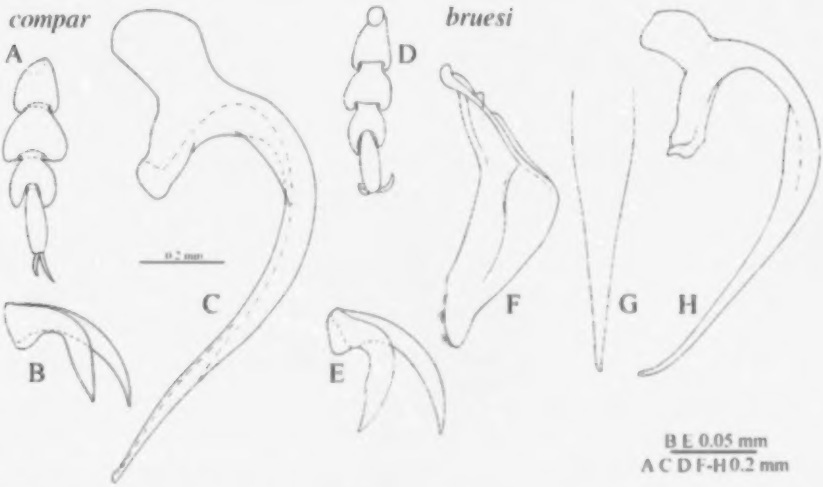
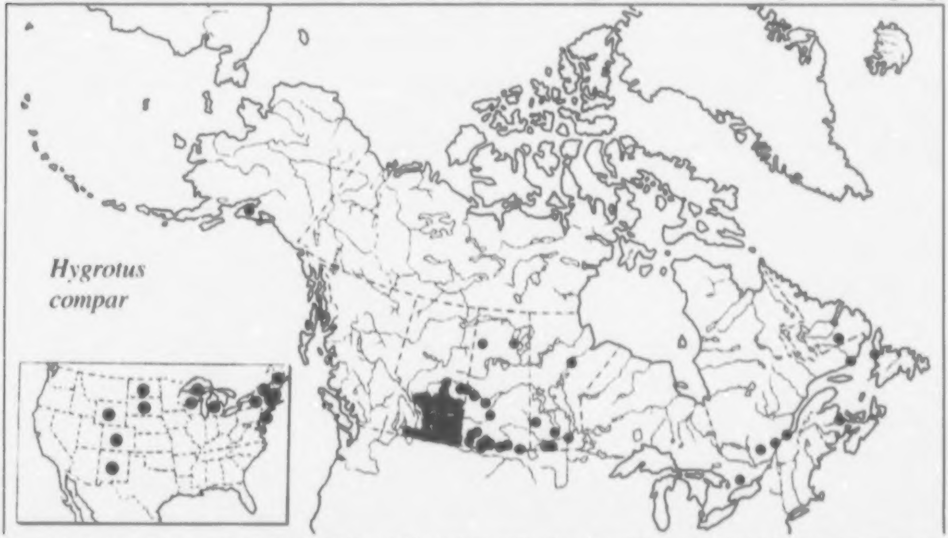


Fig. 30. *Hygrotus*, male. A – C - *H. compar*, A - protarsus, B - protarsal claws anterior, C - aedeagus lateral. D – H - *H. bruesi*, D - protarsus, E - protarsal claws anterior, F - paramere, G - aedeagus apex dorsal, H - aedeagus lateral.

abdomen basolaterally coarsely punctate; metathorax medially and abdomen medially with punctures fine and sparse. Male with head microreticulate otherwise entire body highly polished and lacking microreticulation. Females dimorphic in sculpture, either lacking microreticulation on elytra and metacoxal plates but with abdominal sterna microreticulate, or specimens with entire body dull from dense microreticulation.

Clypeus without a marginal bead. Prosternal process longitudinally carinate medially; contacting metasternum.

Male with protarsomeres (Fig. 30A) 1 to 3 broadly dilated; protarsomere 2 about one and one-half as wide as tarsomeres 1 or 3. Anterior protarsal claw (Fig. 30B) slightly



Map 40. *Hygrotus compar* (Fall).Canadian and Alaskan collection localities and United States state records.

shorter than posterior, strongly arcuate basally. Aedeagus (Fig. 30C) elongate, apical half of shaft almost straight but with a slight sinuation and dorsal reflexion of apex.

Ecology. Larson (1975) recorded the species from the margin of temporary prairie ponds. The species usually occurs in fresh water but specimens have also been found in saline prairie ponds.

Distribution. Map 40. The range extends from western Newfoundland and New Brunswick to Alaska (Skilak Lake, Kenai Peninsula, 1 specimen in CNC) and south to New Mexico in the west.

13. *Hygrotus bruesi* (Fall 1928)

Fig. 30D – H

Coelambus bruesi Fall 1928: 64 – 65. Type locality - Ruby Valley, 65 mi S Wells, Nevada. (Anderson stated the type was a teneral male).

Selected Reference. Anderson 1976: 582 – 583.

Description. Length = 3.3 to 4.0 mm; width = 1.7 to 2.1 mm; length: width = 1.84 to 1.96. Body elongate-oval, pronotum and elytra with lateral margins more or less continuous in outline.

Color rufous to reddish brown. Head reddish brown, most specimens with a diffuse infuscate spot mesad to each eye and a postmedial spot; antenna and palpi yellow basally, infuscate apically. Pronotum pale reddish brown with a small, diffuse spot on median fovea; anterior and posterior margins translucent and appearing dark but not pigmented. Elytron yellow-brown, translucent, non-pigmented or with a vague darker brown area medially and apically. Ventral surface mainly piceous to black. Legs reddish brown.

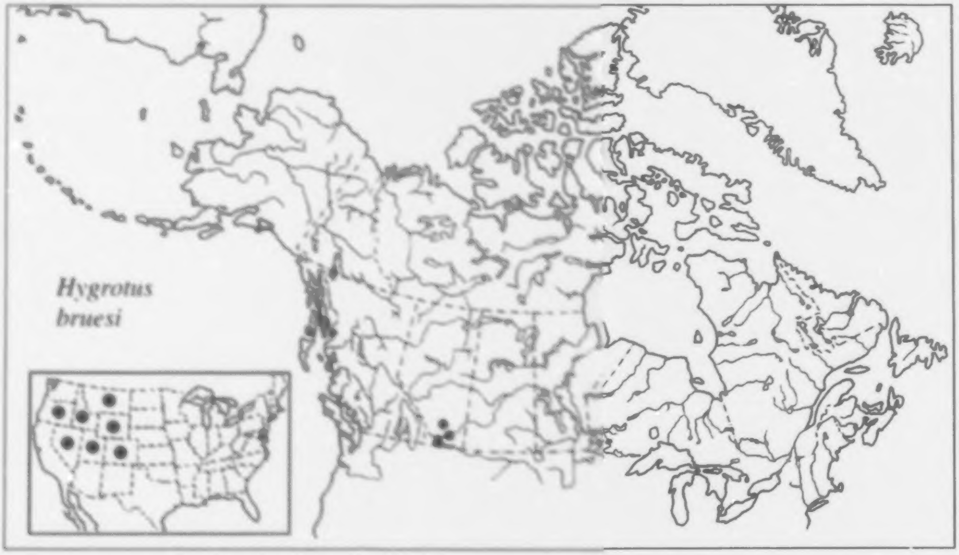
Sculpture only slightly varying sexually. Male head with small punctures; pronotum finely and sparsely punctate medially, punctures larger and denser towards margins, posterior margin with intermixed coarse umbilicate punctures. Elytron basally with punctation dual consisting of intermixed small punctures and less numerous larger umbilicate punctures subequal in size to distinct serial punctures, punctures more even in size medially and apex with dense, coarse punctures; epipleuron with shallow well separated punctures. Metepisternum impunctate. Metasternal wings with punctures very coarse, irregular and more or less contiguous; medially metasternum impunctate except for irregular submedial series of very small punctures. Metacoxal plates with punctures slightly smaller, coarsest laterally, smaller and more regular medially and in mesal half punctures small, sparse and irregularly scattered. Sterna 1 and 2 with punctures coarse, more or less regular, punctation of rest of abdomen small but distinct. Body shiny, without microreticulation except on head and faint remnants mediolaterally on metasternum, near hind margin of metacoxal plate and on sternum 6. Female sculpture similar to that of male but sterna 3 to 6 with lightly impressed reticulation.

Clypeus without anterior bead. Prosternal process narrow, medially carinate, its apex received into impression on metasternum. Sternum 6 not modified.

Male protarsus (Fig. 30D) distinctly dilated, width of protarsomere 2: width of protibia = 0.60 to 0.78 (width protibia = 0.16 to 0.19 mm); protarsomere 2 about 1.08 to 1.33 times wider than protarsomere 1; protarsal claws (Fig. 30E) dissimilar, anterior claw slightly shorter and more strongly arcuate basally than posterior. Aedeagus (Fig. 30G, H) in lateral aspect with apex broadly and evenly arcuate downwards.

Ecology. The appearance of this species in Canada has been very irregular. Larson (1975) saw one Alberta specimen which was tentatively identified as *H. compar*. Since that time several long series have been collected but generally only on a single year from any one location. Subsequent searches usually fail to find specimens. The longest Canadian series seen was collected from small, temporary roadside pools adjacent to the town of New Dayton, Alberta (12 July 1989). These pools fill irregularly, remaining dry in some years when their bottom is covered with a crust of white alkali salts. The beetles were collected in a wet year when the pools were filled naturally as well as from irrigation runoff which raised the water levels so that surrounding grasses were flooded. It was amongst the flooded grass stalks that the beetles occurred. The high water levels had diluted the salts so that the ponds were not noticeably saline and they had a large population of mosquito larvae and anostracans. Alkali salts were present along the shorelines of several other pools in Alberta and Wyoming where specimens were collected. Specimens are not known from larger saline lakes. A specimen was collected at light in late May (Idaho, CARR).

Distribution. Map 41. This species is known from only a few localities in the western Great Plains, from southern Alberta to Colorado and in the northern Great Basin.



Map 41. *Hygrotus bruesi* (Fall). Canadian and Alaskan collection localities and United States state records.

14. *Hygrotus dissimilis* Gemminger and Harold 1868

Fig. 31

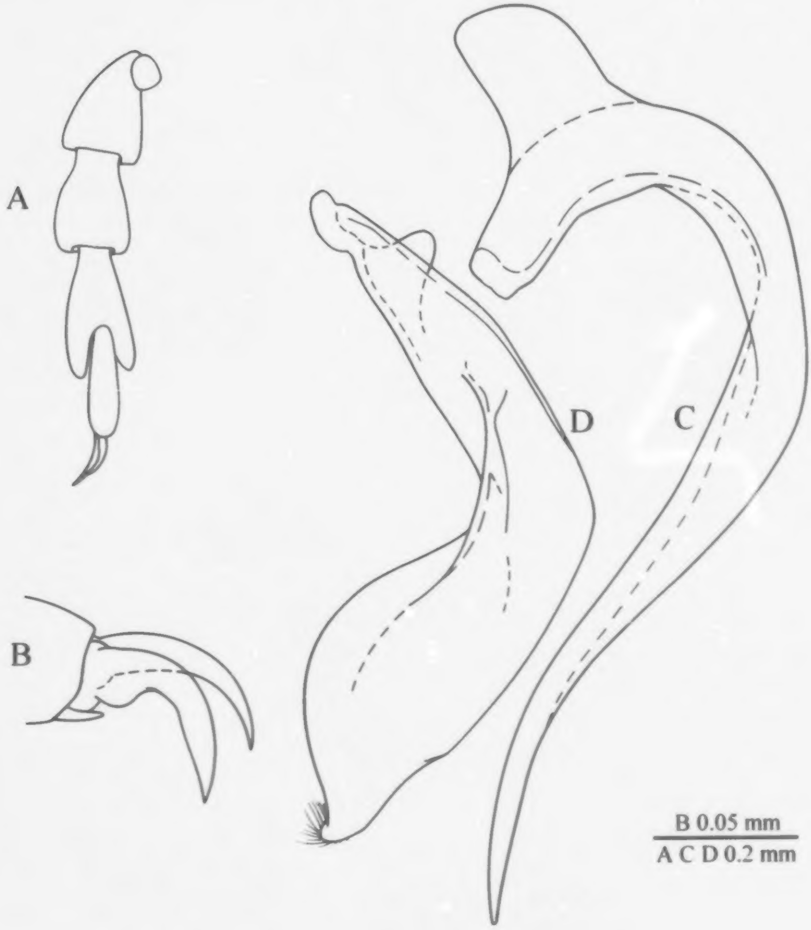


Fig. 31. *Hygrotus dissimilis*, male. A - protarsus, B - protarsal claws anterior, C - aedeagus lateral. D - paramere.

Hydroporus dispar LeConte 1850: 216. Type locality - Lake Superior. [not Germar 1848].

Hygrotus dissimilis Gemminger and Harold 1868: 432. New name for *Hydroporus dispar* LeConte.

Selected References. Anderson 1976: 581; Hilsenhoff 1994: 281 – 282.

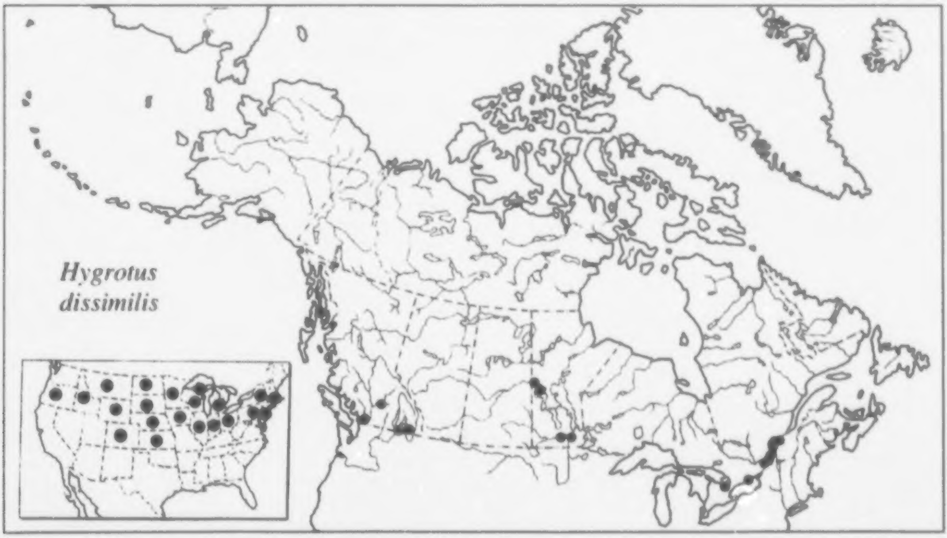
Description. Length = 3.6 to 4.3 mm; width = 1.9 to 2.2 mm; length: width = 1.89 to 1.96.

Body dorsally pale reddish brown. Head with posterior margin narrowly darker brown on most specimens; antenna pale basally, infuscate apically; palpi pale, apical maxillary palpomere lightly infuscate or not. Pronotum with anterior and posterior margins medially appearing darker, with a small darker spot on medial fovea. Elytron generally darker than pronotum, with sutural margin, and on some specimens an ill-defined medial area of disc, slightly darkened. Venter black except metasternum medially, metacoxal processes and abdominal sterna 1 and 6 of some specimens, red.

Head and pronotum distinctly punctate; pronotum with punctures of more or less uniform size except a few large punctures along posterolateral margin. Elytron irregularly punctate with coarse punctures (larger than serial punctures) irregularly scattered on disc and on average separated by more than their own diameters, these interspersed with much smaller punctures; disparity in puncture sizes best developed on basal two thirds, apically larger punctures more numerous and uniform in distribution. Metacoxal plate less coarsely punctate than metasternal wing, coarse punctures separated by about their own diameters. Sternum 6 very lightly punctate, posteromedial impression impunctate. Male with microsculpture absent except for traces of lines on head. Female shiny, microsculpture as reduced as on males or some specimens with faint rudiments of lines on lateral portions of pronotum, metacoxal plates and abdominal sterna.

Clypeus without an anterior bead. Prosternal process elongate and contacting metasternum. Metacoxal lines only slightly divergent anteriorly, not quite or actually attaining metasternum. Sternum 6 with a medial, oval impression on apical 0.33 to 0.5, best developed on male but also evident on female.

Male protarsomeres (Fig. 31A) 1 to 3 narrow, not distinctly dilated; anterior protarsal claw (Fig. 31B) slightly arcuate basally, both claws small. Aedeagus (Fig. 31C) sinuate in lateral aspect, apex recurved dorsally; paramere (Fig. 31D) L-shaped.



Map 42. *Hygrotus dissimilis* Gemminger and Harold. Canadian and Alaskan collection localities and United States state records.

Ecology. Hilsenhoff (1994) stated the species occurs in shallow, often temporary, ponds and marshes. In British Columbia specimens have been collected from amongst emergent sedges and grasses in ponds and ditches. The mature larva was described by Alarie *et al*. (1990).

Distribution. Map 42. This species is transcontinental in distribution in the northern United States. In Canada it occurs from southern Quebec to southern British Columbia but is absent from the prairies.

15. *Hygrotus nigrescens* (Fall 1919)

Fig. 32A, B

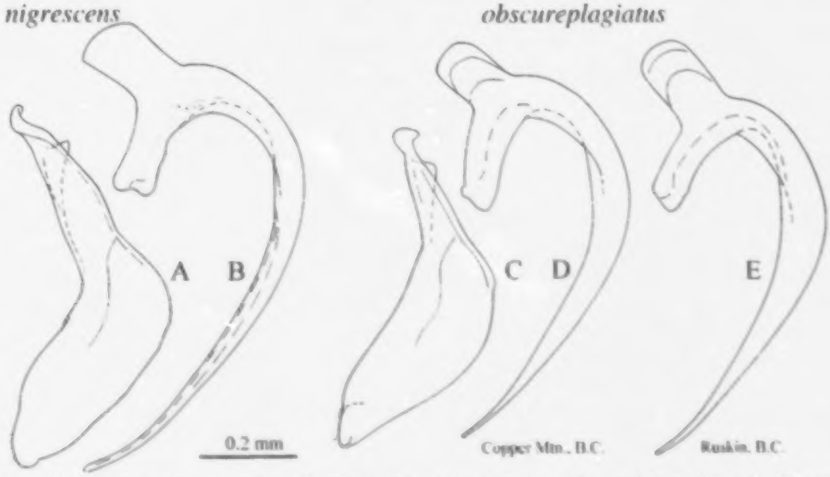


Fig. 32. *Hygrotus, male*. A – B - *H. nigrescens*, A - paramere, B - aedeagus lateral. C – E - *H. obscureplagiatus*, C - paramere, D – E - aedeagus lateral.

Coelambus nigrescens Fall 1919: 9. Type locality - Farrington, Mono Lake, Mono Co., California.

Selected Reference. Anderson 1976: 581.

Description. Length = 3.3 to 3.8 mm; width = 1.7 to 1.9 mm; length: width = 1.88 to 1.96.

Head dark reddish brown with anterior margin of clypeus paler; antenna yellow basally, antennomeres 4 or 5 to 11 darkly infuscate; palpi pale basally, apical palpomere of each palpus infuscate. Pronotum dark reddish brown, anterior and posterior margins darker. Elytron more or less uniformly reddish brown with sutural and basal margins narrowly piceous and humeral area and epipleuron slightly paler. Ventral surface mainly black. Legs reddish brown, femora and tarsi of some specimens slightly darkened.

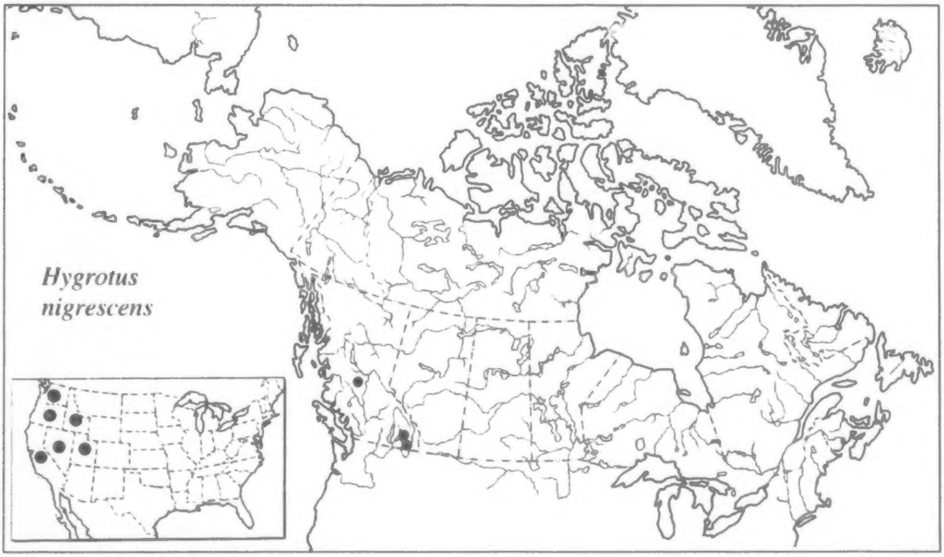
Elytron with punctation dual (strongly reticulate females may have punctation obscured or elytral punctures subequal in size); coarser punctures set in shallow depressions, irregular in distribution basally and interspersed with slightly more numerous small punctures; dual punctation best developed basally, apical half of disc with punctures less disparate in size and more regularly distributed. Ventral surface with coarse punctures on metasternal wings, metacoxal plates and laterobasal portions of abdomen; metasternum medially with very small punctures. Sternum 6 more or less uniformly coarsely punctate. Male with microreticulation on head otherwise body shiny, microreticulation absent or represented by faint remnants near pronotal fovea and abdominal sterna. Females dimorphic in sculpture, specimens either shiny and similar to male or with dense microreticulation over entire body (over 90% of Canadian specimens examined of sculptured form).

Clypeus without an anterior marginal bead. Prosternal process elongate, contacting metasternum. Sternum 6 not modified.

Male protarsus strongly dilated; tarsomere 2 very broad, tarsomere 3 about 0.75 times width of 2, deeply bilobed and asymmetrical with posterior lobe broader than anterior; tarsomere 1 narrower than 3; anterior protarsal claw strongly bent basally, apex flattened and evenly narrowed to awl-like point; posterior claw not modified. Aedeagus (Fig. 32B) elongate, apex slightly curved ventrad.

Ecology. The species occurs among emergent vegetation of ponds and ditches. It probably breeds in temporary ponds, at least in part, for teneral specimens were swept from vegetation in a dried marsh (Utah, Woodruff, 29 July, CARR). Teneral specimens have also been collected in early August.

Distribution. Map 43. The range extends from British Columbia to Colorado, Utah and California.



Map 43. *Hygrotus nigrescens* (Fall). Canadian and Alaskan collection localities and United States state records.

16. *Hygrotus obscureplagiatus* (Fall 1919)

Fig. 32C – E

Coelambus obscureplagiatus Fall 1919: 13. Type locality - Port Townsend, Washington.

Coelambus columbianus Brown 1930*a*: 87 - 88. Type locality - Copper Mountain, Creston, B.C.

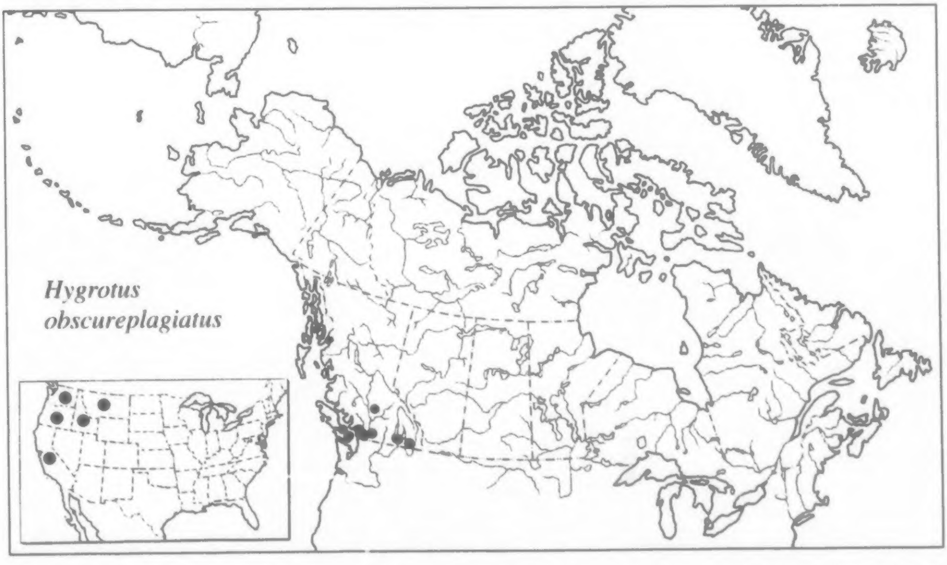
Selected Reference. Anderson 1983: 193.

Description. Length = 3.5 to 4.0 mm; width = 1.8 to 2.0 mm; length: width = 1.88 to 1.96.

Color of head red to chestnut brown, uniformly colored or with posterior margin and a spot mesad to each eye variously darkened; antenna yellow basally, antennomeres 4 or 5 to 11 infuscate; palpi yellow except apical palpomeres infuscate. Pronotum yellow brown with anterior and posterior margins piceous and some specimens with a faint posteromedial brown cloud on disc. Elytron yellow brown with disc variously maculate; some specimens more or less uniformly colored without evident maculations; others with a darker brown discal cloud which on base forms three longitudinal bands or vittae which posteriorly fuse to form a large, ill-defined darker area which extends to apex but is limited laterally by paler margin. Ventral surface mainly black. Legs pale brown to piceous.

Elytron with punctures large, of varied but more or less similar size and not evidently dual, separated by about their own diameters. Ventral surface coarsely punctate laterally, punctures more distinct medially on abdominal sterna than on similar species. Male with head microreticulate otherwise body smooth and shiny or on some specimens metacoxal plates irregularly rugose from obsolete microreticulation. Females dimorphic, either with dorsal surface shiny and lacking microreticulation on pronotum and elytron and ventral surface with light microreticulation, or entire body dull due to microreticulation.

Clypeus without an anterior margin. Prosternal process narrow, elongate and contacting metasternum; in cross section compressed laterally and carinate medially. Sternum 6 not modified.



Map 44. *Hygrotus obscureplagiatus* (Fall). Canadian and Alaskan collection localities and United States state records.

Male protarsus broadly dilated, protarsomere 2 1.3 to 1.5 times wider than protarsomeres 1 or 3 which are subequal in width; protarsal claws subequal in length, anterior claw strongly bent basally, apex awl-like; posterior claw not modified. Aedeagus (Fig. 32D, E) arcuate basally, apical third more or less straight but ventral margin on most specimens with a faint sinuation, evidently but variously broadened medially; paramere (Fig. 32C) broad apically, apex setose on internal margin.

Ecology. John Carr (*in lit.*) collected specimens from among emergent sedges, grass and plant debris in shallow water of more or less permanent, muddy bottomed ponds and excavations such as highway ditches.

Distribution. Map 44. All Canadian records are from southern British Columbia. The United States range includes the Pacific Northwest, east to Montana and south to northern California.

17. *Hygrotus patruelis* (LeConte 1855)

Fig. 33

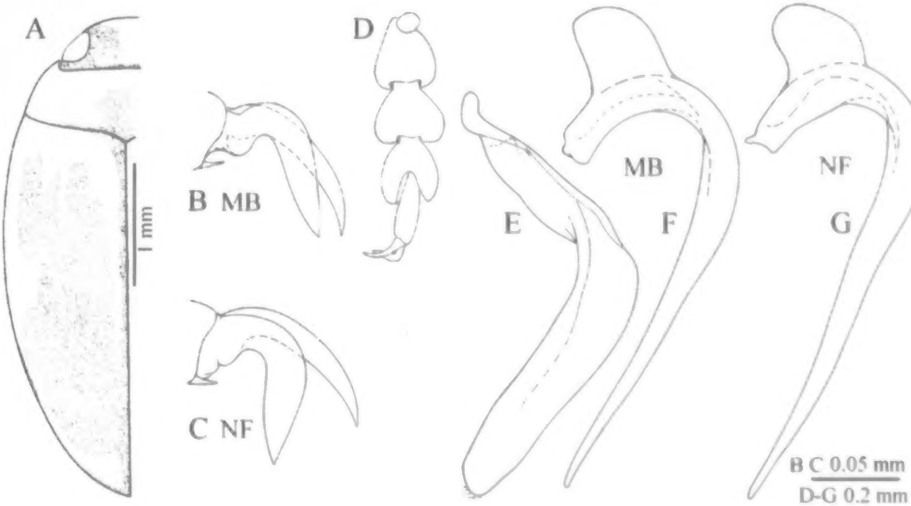


Fig. 33. *Hygrotus patruelis*, male. A - body outline, B – C - protarsal claws anterior, D - protarsus, E - paramere, F – G - aedeagus lateral, MB - Manitoba specimen, NF - Newfoundland specimen.

Hydroporus patruelis LeConte 1855: 298. Type locality - Fort Laramie, Wyoming.

Hydroporus discoideus LeConte 1855: 299.

Coelambus borealis Fall 1926: 137. Type locality - Dawson, Yukon Territory.

Coelambus quebecensis Brown 1930b: 234. Type locality - Bragg Harbour, Quebec.

Selected References. Larson 1975: 271; Anderson 1983: 194; Hilsenhoff 1994: 284.

Description. Length = 3.3 to 4.2 mm; width = 1.7 to 2.2 mm; length: width = 1.85 to 2.00. Body (Fig. 33A) elongate, oval, lateral margin more or less continuous.

Head reddish yellow medially and anteriorly, posterior margin and frons mesad to each eye darker, brown; antenna and palpi yellow basally, infuscate distally. Pronotum reddish yellow with an expanded medial brown spot which is separated from front margin but contiguous with hind margin; some specimens with disc basolaterally of medial spot infuscate. Elytron yellow basally and laterally, disc with variously developed non-vittate maculations; most specimens with a small subhumeral spot and a large postmedial spot from which two or three projections extend anterad onto basal area; darkest specimens with most of disc brown to piceous, some specimens with entire disc yellow. Pale ground color of head and pronotum more evidently reddish than pale areas of elytron. Ventral surface mainly black. Legs reddish or brown with tarsi infuscate on most specimens.

Elytron with dense moderate sized punctures; punctures subequal to or slightly smaller than serial punctures, irregular in size basally but not forming two distinct size classes. Metasternal wing, metacoxal plate and sterna 1 and 2 coarsely punctate. Sternum 6 coarsely punctate, medially punctures adjacent to apical bead crowded Extent of microreticulation on body various; males with elytra and abdominal sterna shiny and lacking microreticulation, metacoxal plates shiny (specimens from prairies) or microreticulate (boreal specimens); females with entire body microreticulate (specimens from New Mexico and southern Great Plains, shiny).

Clypeus lacking anterior bead. Prosternal process elongate and contacting metasternum. Abdominal sterna not modified in either sex.

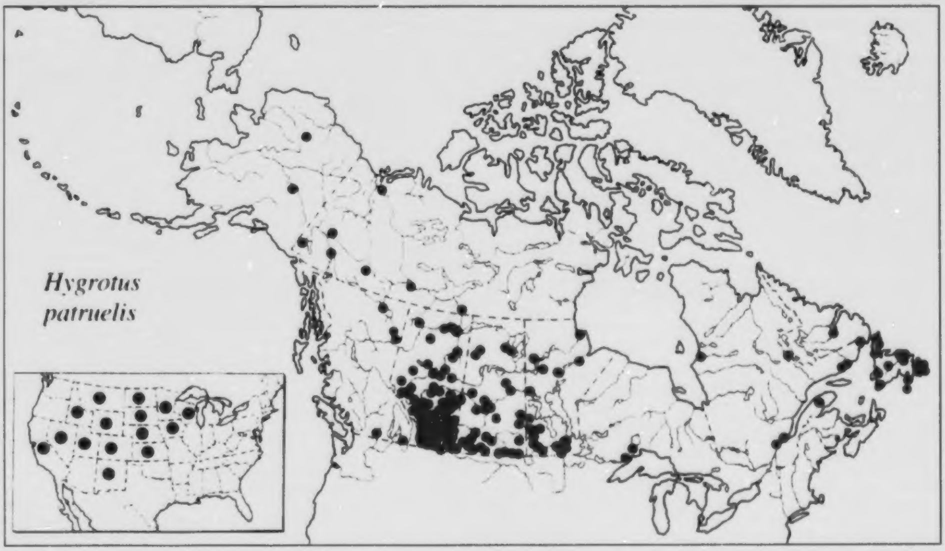
Male protarsus (Fig. 33D) broadly dilated, protarsomere 2 slightly broader than 1 which in turn is slightly broader than 3; protarsal claws (Fig. 33B, C) subequal, anterior strongly bent basally, evenly tapering to acute apex. Aedeagus (Fig. 33F, G) elongate, more or less straight in apical half to two thirds; paramere (Fig. 33E) L-shaped, elongate.

Comments. There is a decrease in the extent of microreticulation on specimens from north to south with the pattern appearing to be clinal. There is also slight variation in the width of the male anterior protarsal claw and the width and sinuation of the aedeagus but there does not seem to be grounds for recognizing infraspecific groups.

Two similar species, *H. collatus* (Fall) and *H. wardii* (Clark) occur in the western United States. These species differ from *H. patruelis* in that the elytral punctation is uniform, the male protarsi are not so broadly dilated with protarsomeres 1 and 2 of approximately equal width and the female is usually (*H. wardii*) or always (*H. collatus*) shiny. The aedeagus of *H. collatus*, like that of *H. patruelis*, is straight apically in lateral aspect whereas that of *H. wardii* has a slight dorsal curvature in the apical quarter. *Hygrotus collatus* occurs in Utah, Nevada, New Mexico, Arizona and California; *H. wardii* occurs in southern New Mexico and Arizona and Mexico.

Ecology. On the prairies, this species occurs along the margins of small ponds, usually among flooded or emergent vegetation but also on clay or mineral substrates. Specimens are sometimes found in slightly saline water but it is not a halophilic species. In boreal regions it occurs almost exclusively on bare clay or gravel substrates and is found most frequently in artificial habitats such as highway borrow pits. In Newfoundland, specimens have been found on firm, bare peat along the margins of eroding peat pools. The mature larva was described by Alarie *et al.* (1990).

Distribution. Map 45. This species occurs mainly in the boreal and Great Plains regions. Its range extends from Newfoundland to southwestern British Columbia, the Yukon Territory and Alaska, and south to New Mexico and California.



Map 45. *Hygrotus patruelis* (LeConte). Canadian and Alaskan collection localities and United States state records.

18. *Hygrotus nubilus* (LeConte 1855)

Fig. 34

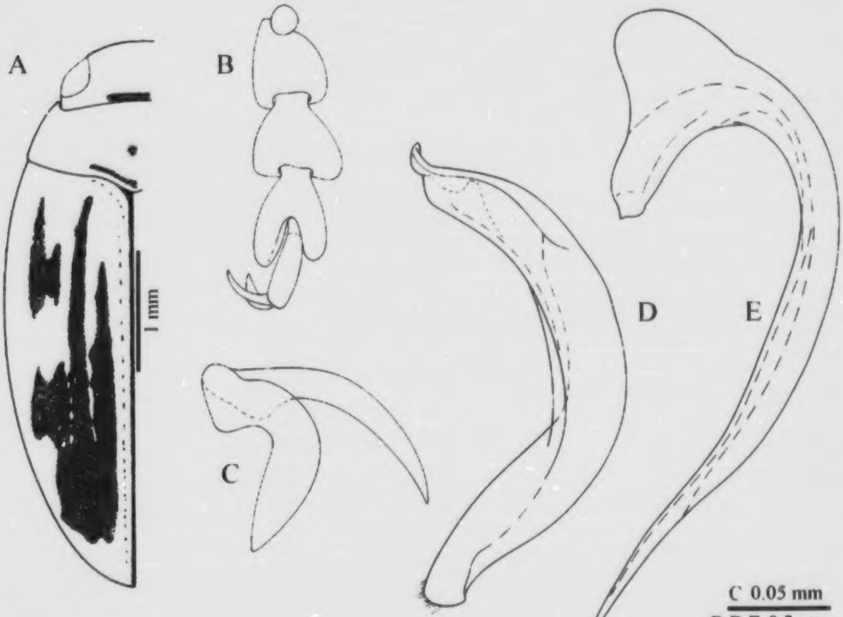


Fig. 34. *Hygrotus nubilus, male*. A - body outline, B - protarsus, C - protarsal claws anterior, D - paramere, E - aedeagus lateral.

F3

Hydroporus nubilus LeConte 1855: 298–9. Type locality - Fort Laramie, Wyoming.

Selected References. Anderson 1983: 189; Hilsenhoff 1994: 283 – 284.

Description. Length = 3.8 to 4.7 mm; width = 1.9 to 2.3 mm, length: width = 1.90 to 2.07. Moderate sized, body (Fig. 34A) elongate-oval, slightly depressed.

Head and pronotum yellow to reddish yellow. Head with or without a small dark spot medially on posterior margin; antenna yellow, distal antennomeres infuscate apically; palpi yellow. Pronotum with a small medial discal spot. Elytron with color pattern various, most specimens with two well developed longitudinal vittae on disc near suture, these separate basally but on many specimens broadened and contiguous apically, subsutural vitta beginning well posterad of base of vitta 2; laterally disc with a pair of vittae (vittae 3 and 4), these broken medially on most specimens and anterior and posterior portions fused respectively to produce anterior and posterior spots; anterior spot isolated on most specimens but posterior spot contiguous with mesal vittae. Ventral surface black. Legs yellow to pale brown.

Elytron with small, even sized punctures which are clearly separated from one another; serial punctures on vittae larger; epipleuron with small, dense punctures. Metasternum and metacoxal plates laterally coarsely punctate, metacoxal plate laterally with punctures more or less confluent and rugose, mesad punctures smaller and separated. Abdomen coarsely punctate basally and laterally, sterna 3 to 6 densely but relatively finely punctate. Male shiny with microreticulation absent except for faint traces on bases of abdominal sterna. Female with lightly impressed microreticulation over entire body or some specimens with reticulation absent or effaced on disc of pronotum and base of elytra.

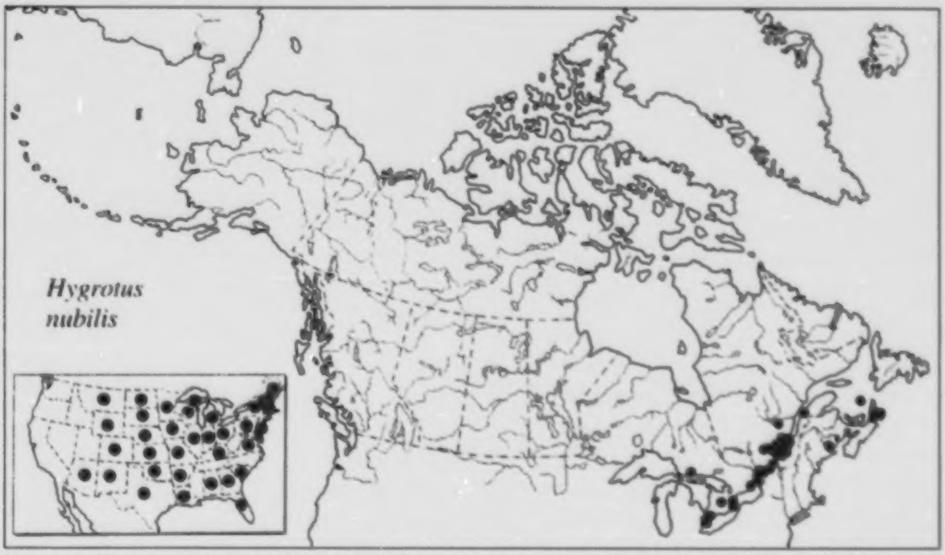
Clypeus without an anterior bead. Pronotum broad, sides evenly rounded laterally and forming a more or less even arc with elytra in dorsal aspect. Elytron in lateral aspect with lateral margin gradually and evenly arcuate to humeral angle; epipleuron disappearing or very narrow posterad to shoulder. Prosternal process with basal prominence evident but obtuse; apex elongate and contacting metasternum.

Male with protarsus (Fig. 34B) broadly dilated; protarsomere 2 slightly broader than 1 which is slightly broader than 3. Anterior protarsal claw (Fig. 34C) subequal in length to posterior, strongly arcuate basally, apex straight, broad and awl-like; posterior claw not modified. Aedeagus (Fig. 34E) elongate, faintly sinuate in lateral aspect; paramere (Fig. 34D) large, of more or less uniform width throughout its length, apex bluntly rounded and with fine setae on mesal face.

Comments. *Hygrotus femoratus* (Fall), known only from two male specimens (one each from Albuquerque, New Mexico, and Phoenix, Arizona), is indistinguishable from *H. nubilis* in all characters except for peculiarly modified legs of the male. The apex of each femur is enlarged and the meso- and metatibia are strongly constricted and more or less pedunculate basally (Anderson 1983, Fig. 38). Anderson (1983) suggested this may be a "deviant form" of *H. nubilis*.

Ecology. Specimens have been collected from among dense emergent grasses and rushes along the margins of small open ponds. Most specimens have been found in artificial ponds such as gravel pit pools and generally in ponds that appear to be permanent or have water present during much of the season.

Distribution. Map 46. This species has a wide distribution in the eastern portion of the continent, extending west to New Mexico and eastern Arizona. It enters southern Canada only east of the Great Plains.



Map 46. *Hygrotus nubilis* (LeConte). Canadian and Alaskan collection localities and United States state records.

19. *Hygrotus falli* (Wallis 1924)

Fig. 35

Coelambus falli Wallis 1924: 107 – 8. Type locality - Beaver Island, Charlevoix Co., Michigan.

Selected References. Anderson 1983: 190; Hilsenhoff 1994: 282.

Description. Length = 3.9 to 4.6 mm; width = 2.1 to 2.3 mm, length: width = 1.87 to 2.03. Moderate size, body (Fig. 35A) elongate; in dorsal aspect pronotum slightly discontinuous in outline with elytra, in lateral aspect somewhat humpbacked with point of maximum depth well posterior to middle.

Head yellow to reddish, darker towards hind margin on some specimens; antenna yellow with antennomeres 7 to 11 infuscate; palpi yellow, infuscate apically. Pronotum yellow to red except anterior and posterior margins narrowly piceous; some specimens with a small medial brown or piceous spot on disc. Elytron yellow with basal and sutural margins narrowly piceous, disc with 4 elongate piceous vittae and a smaller sublateral piceous spot, vitta 4 broken medially on some specimens; vittae for the most part separate but on some specimens shortly expanded and confluent basally, at middle and/or at apex. Ventral surface mainly black. Legs yellow except pro- and mesotarsi infuscate.

Entire dorsal surface strongly punctate. Pronotum with submarginal punctures irregularly longitudinally confluent. Elytron with punctures of various sizes but punctation not obviously dual. Ventral surface strongly punctate, punctures on metacoxal

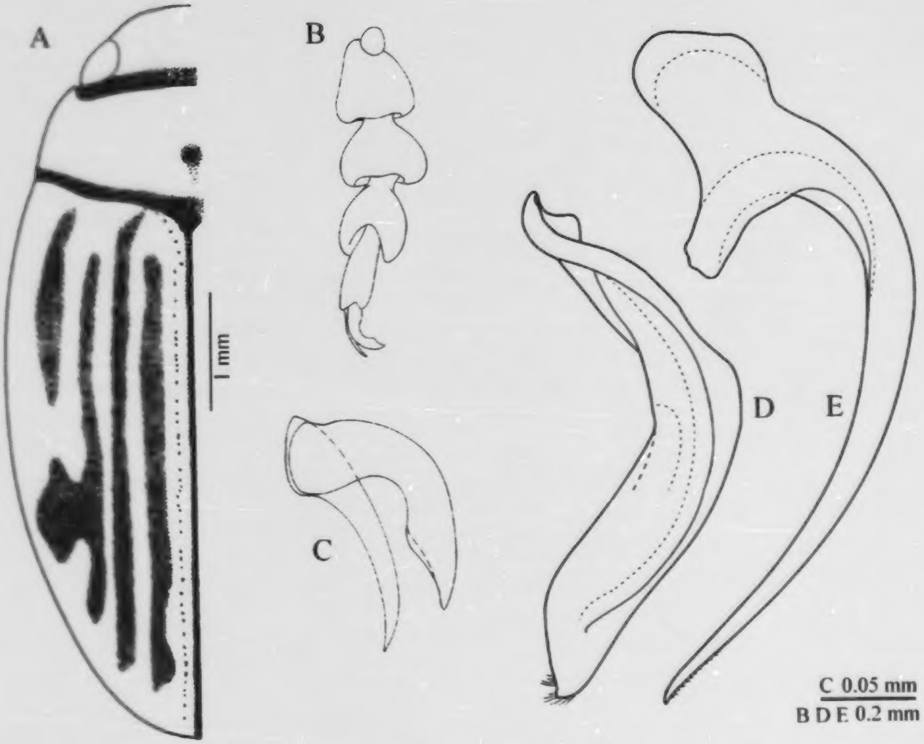


Fig. 35. *Hygrotus falli*, male. A - body outline, B - protarsus, C - protarsal claws anterior, D - paramere, E - aedeagus lateral.

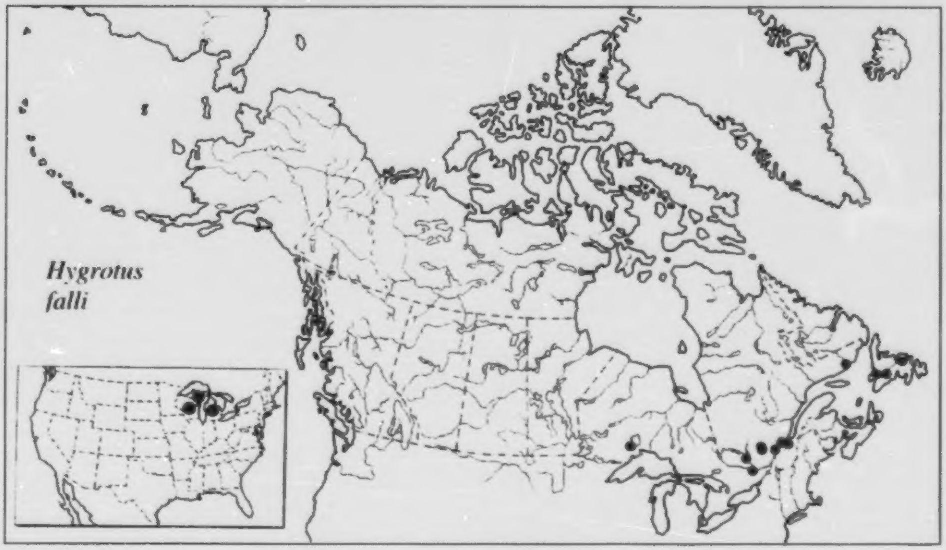
plates large and dense, irregularly transversely confluent; sternum 6 more or less evenly coarsely punctate. Male lacking microreticulation, even on head. Female with fine lines over entire body and body dull.

Clypeus lacking anterior bead. Pronotum with disc convex, submarginal areas of front margin flattened or vaguely impressed. Elytron in lateral aspect with dorsal margin evidently angulate at about middle of length, sutural margin more or less horizontal in basal half then curved downwards towards apex; lateral margin strongly ascendant, epipleuron visible to shoulder. Prosternal process with basal prominence distinct but obtuse; blade relatively broad, contacting metasternum.

Male protarsus (Fig. 35B) broadly dilated, protarsomere 2 slightly wider than 1 which in turn is slightly broader than 3; anterior protarsal claw (Fig. 35C) slightly shorter than posterior, broader and more strongly arcuate, with a subapical ventral expanded area and with apex obliquely truncate; posterior claw and mesotarsal claws not modified. Aedeagus (Fig. 35E) slender, apex more or less straight and with minute dorsal denticles.

Ecology. This is a poorly collected species and its usual habitats are not known. Newfoundland specimens have been collected from among emergent vegetation at the margin of small, exposed, artificial ponds. Hilsenhoff (1994) found specimens along the sand and gravel shoreline of a lake. The mature larva was described by Alarie *et al.* (1990).

Distribution. Map 47. This species has a range that extends from Newfoundland to western Ontario and Wisconsin.


Hygrotus falli

Map 47. Hygrotus falli (Wallis). Canadian and Alaskan collection localities and United States state records.

20. *Hygrotus novemlineatus* (Stephens 1828)
Fig. 36

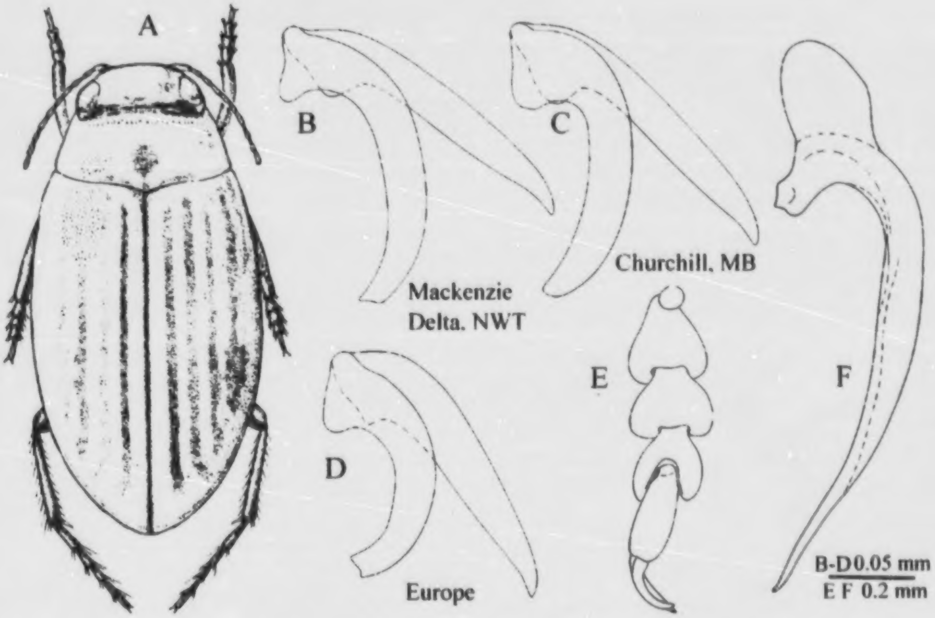

A
B
C
Churchill, MB
Mackenzie Delta, NWT
E
F
D
Europe
B-D 0.05 mm
E F 0.2 mm

Fig. 36. *Hygrotus novemlineatus*. A - habitus, B – D - male protarsal claws anterior, E - male protarsus, F - aedeagus lateral.

Hydroporus novemlineatus Stephens 1828: 192. Type locality - Lapland.

Coelambus hudsonicus Fall 1919: 18–9. Type locality - Ungava Bay, Quebec.

Selected References. Anderson 1983: 190; Nilsson and Holmen 1995: 37 – 38.

Description. Length = 3.8 to 4.3 mm; width = 1.8 to 2.2 mm; length: width = 1.91 to 2.04. Moderate size, body elongate-oval (Fig. 36A).

Color dorsally testaceous with brown or piceous markings as follows; posterior margin of head and frons mesad to each eye; a medial spot on pronotum; elytron with sutural margin and four longitudinal discal vittae, vittae 1 to 3 complete, vitta 4 broken medially on most specimens and widened posteriorly to contact apex of vitta 3. Antenna pale with outer antennomeres infuscate; palpi yellow with apical infuscation. Legs pale except tarsi variously darkened. Venter mainly black.

Pronotum with punctation relatively fine and sparse medially, denser and coarser laterally. Elytron relatively densely punctate with punctures small but slightly irregular in size; serial punctures evident but not longitudinally contiguous. Venter sparsely punctate with small punctures on lateral portions of metasternal wings, metacoxal plates and basal abdominal sterna; medially punctures small, sparse and obscured by lines of microsculpture; sternum 6 with dense, small deep punctures which are sparser along hind margin. Male head and pronotum shiny but with irregular patches of microreticulation; elytra, metacoxal plates and abdominal sterna microsculptured. Female with body less shiny, microsculpture evident over entire body.

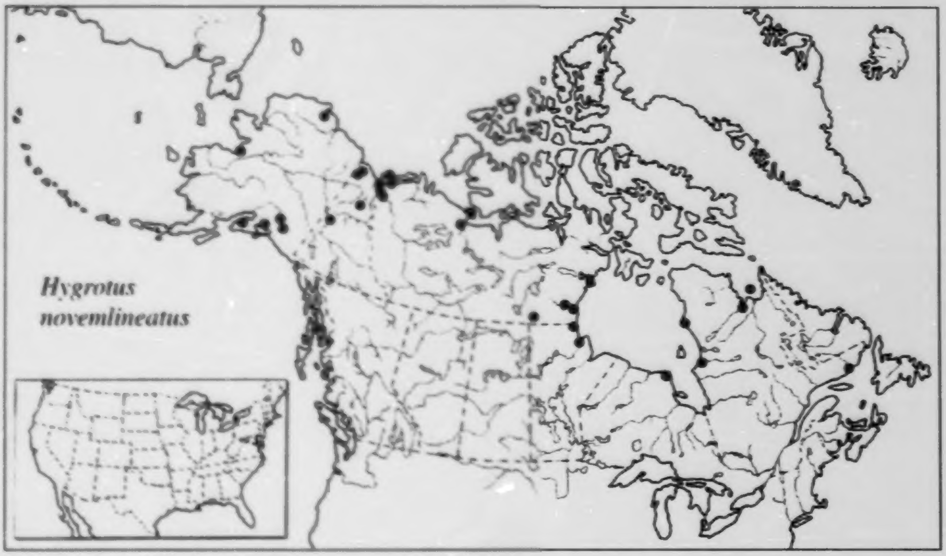
Clypeus without an anterior bead. Pronotum relatively narrow, sides only slightly and broadly arcuate; elytra oval, in lateral aspect dorsal surface convex and broadly curved in middle region; lateral margin moderately strongly ascendant, epipleuron narrowly visible to shoulder in lateral aspect; humeral carina low and on some specimens more or less obsolete, at least dorsally. Prosternal process without a distinct prominence between procoxae; blade short but apically pointed and contacting metasternum and separating mesocoxae. Metacoxal lines subparallel.

Male with protarsomeres (Fig. 36E) 1 to 3 broadly dilated, tarsomere 2 slightly broader than 1 which in turn is slightly broader than 3; anterior and posterior protarsal claws (Fig. 36B – D) modified, anterior about four-fifths length of posterior, of more or less even width and evenly arcuate throughout its length with its apex bluntly pointed or truncated; posterior claw strongly bent at base then more or less straight to sharp apex. Aedeagus (Fig. 36F) with apical two-thirds more or less straight but with very slight sinuation.

Comments. Palaearctic specimens differ from those of eastern North America in that they are shinier, especially the males which have the elytral sculpture largely effaced at least basally, and they are more coarsely punctate ventrally. The male anterior protarsal claw is similar in form but is shorter with the apical truncation closer to the base (Fig. 36D versus Fig. 36B, C). However, specimens from Alaska are intermediate in sculpture and show a reduction in anterior protarsal claw length relative to other North American populations. The aedeagus is identical between Palaearctic and Nearctic specimens. Nilsson and Roughley (in manuscript) assign Nearctic specimens to *H. n. hudsonicus* (Fall).

Ecology. Near Churchill, Manitoba, specimens were taken in brackish splash pools along the coast. Nilsson and Holmen (1995) describe the typical Fennoscandian habitats as sandy oligotrophic lake margins and sparsely vegetated ponds. The larval stages have been described by Nilsson (1983) and Alarie *et al.* (1990).

Distribution. Map 48. This species is circumpolar in the low arctic region. North American records extend from eastern Quebec to Alaska. A specimen labelled Ottawa (CNC) is probably mislabeled and has not been indicated on the map.



Map 48 *Hygrotus novemlineatus* hudsonicus (Fall). Canadian and Alaskan collection localities and United States state records.

21. *Hygrotus infuscatus* (Sharp 1882)
Fig. 37

Coelambus infuscatus Sharp 1882*a*: 401–2. Type locality - Nevada.

Coelambus oregonus Fall 1919: 19. Type locality - Corvallis, Oregon.

Coelambus dentiger Fall 1927*b*: 136. Type locality - Medicine Hat, Alberta.

Selected References. Larson 1975: 273 (as *H. dentiger* Fall); Anderson 1983: 192.

Description. Length = 4.8 to 5.8 mm; width = 2.6 to 2.9 mm; length: width = 1.90 to 2.02. Size large (Fig. 37A), males tending to be larger than females.

Head reddish yellow with posterior margin and a spot mesad to each eye, piceous; antenna and palpi pale, infuscate apically. Pronotum reddish yellow with anterior and posterior margins piceous medially and with a small brown or piceous medial spot. Elytron yellow with sutural margin piceous and disc with variously developed maculations; basically disc with four or five longitudinal vittae which on most specimens are distinct on basal half but are broader and more or less contiguous distally

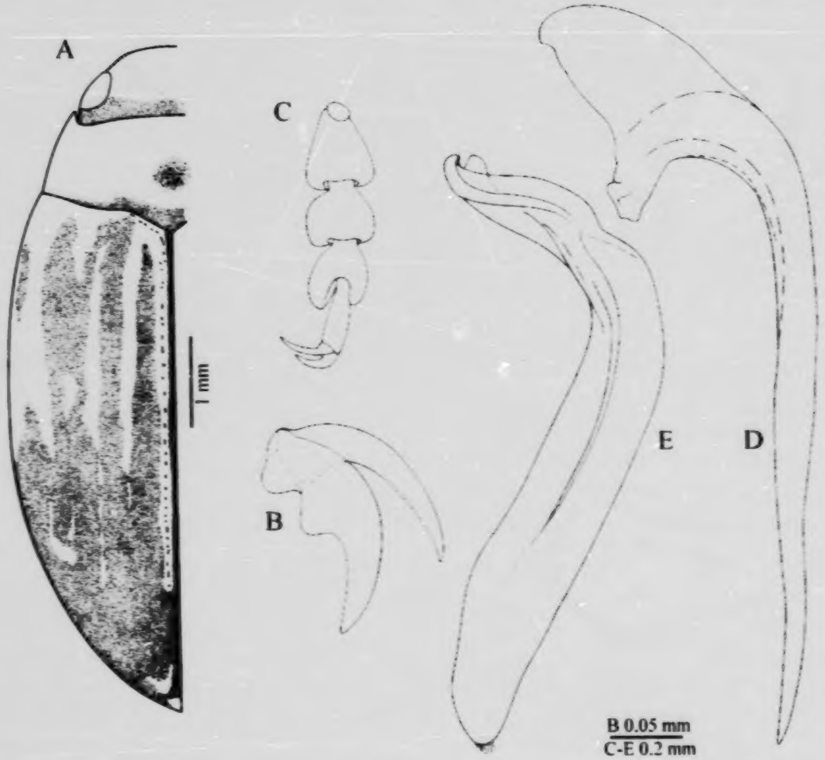


Fig. 37. *Hygrotus infuscatus*, male. A - body outline. B - protarsal claws anterior, C - protarsus, D - aedeagus lateral, E - paramere.

(some specimens with vittae broadly expanded and entire disc dark brown with only lateral, basal and narrow subsutural areas pale). Ventral surface piceous to black. Legs pale brown with terminal tarsomeres of pro- and mesotarsi infuscate on many specimens.

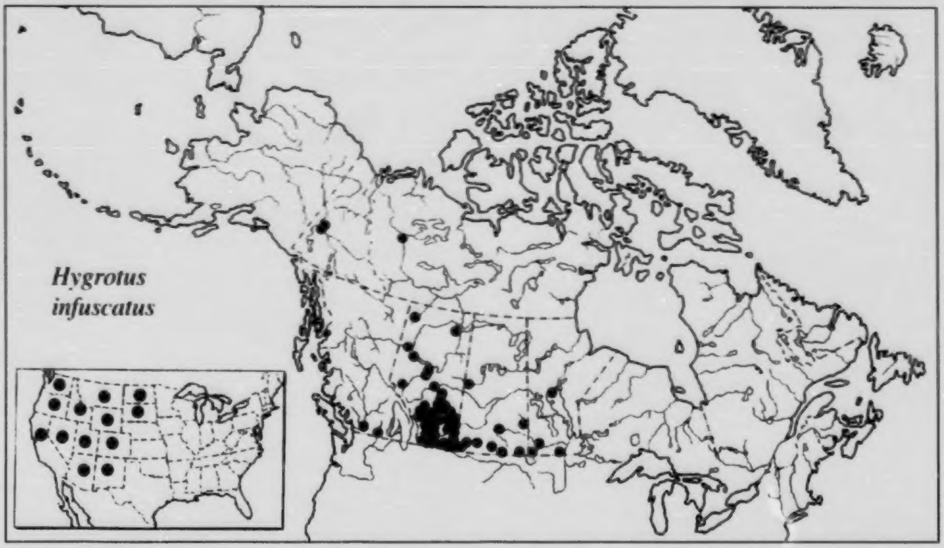
Disc of elytron basally between serial punctures with a few sparse, large punctures subequal in size to serial punctures, and with more numerous interspersed small punctures. Metasternal wing coarsely punctate; metacoxa with slightly smaller punctures anteriorly, punctures smaller and sparser posteriorly; sternum 6 with small punctures, sparser medially and apically. Male elytra, metacoxal plates and abdominal sterna shiny, without microreticulation or some specimens with very lightly impressed open sculpture. Female with elytron smooth basally, with lightly impressed reticulation on apical half to two thirds, metacoxal plates and abdominal sterna with evident microsculpture or with metacoxal plates shiny and lacking sculpture and sterna lightly sculptured (some specimens from west of Rocky Mountains).

Clypeus without an anterior marginal bead. Pronotum with sides evenly and smoothly arcuate throughout length and with maximum width at hind angles. Prosternum with basal prominence obsolete; prosternal process elongate and contacting metasternum. Abdomen with sternum 6 not modified.

Male protarsus (Fig. 37C) broadly dilated, protarsomeres 1 and 2 subequal in width, 3 narrower; anterior protarsal claw (Fig. 37B) slightly shorter than posterior, stouter and bearing a right angled ventral tooth near base; posterior claw not modified. Aedeagus (Fig. 37D) very long and more or less straight in apical two-thirds; paramere (Fig. 37E) with apical portion elongate and parallel sided.

Ecology. This species is most common in small prairie ponds, both temporary and permanent. It occurs in both fresh as well as slightly saline waters.

Distribution. Map 49. This species occurs from Manitoba to British Columbia, north into the Northwest and Yukon Territories and south to New Mexico, Arizona and California.



Map 49. *Hygrotus infuscatus* (Sharp). Canadian and Alaskan collection localities and United States state records.

22. *Hygrotus punctilineatus* (Fall 1919)

Fig. 38

Coelambus punctilineatus Fall 1919: 17. Type locality - Stony Mountain, Manitoba.

Selected References. Larson 1975: 275; Anderson 1983: 187.

Description. Length = 3.6 to 4.2 mm; width = 2.0 to 2.3 mm; length: width = 1.73 to 1.87. Body (Fig. 38A) moderate size, broadly oval.

Head yellow except posterior margin and an anterior extension along mesal margin of each eye, black; antennae and palpi yellow, infuscate apically. Pronotum yellow except anterior margin medially, and on some specimens also posterior border, narrowly piceous; disc with a small medial brown spot. Elytron testaceous except sutural margin narrowly piceous; disc with four or five longitudinal piceous or black vittae,

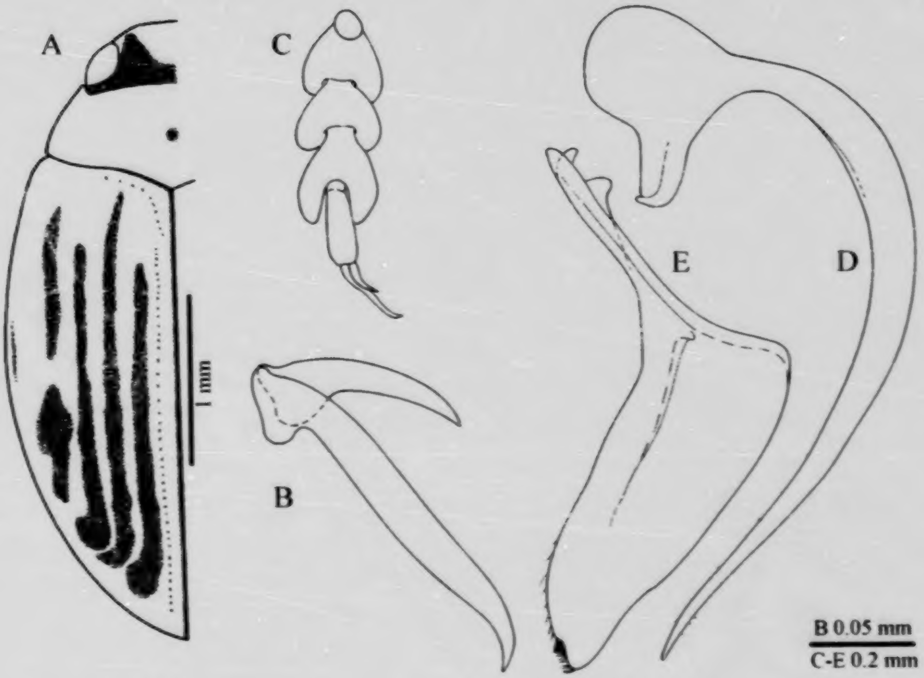


Fig. 38. *Hygrotus punctilineatus*, male. A - body outline. B - protarsal claws anterior, C - protarsus, D - aedeagus lateral, E - paramere.

vittae 1 to 3 complete, narrowest anteriorly and broadened behind but on most specimens separate throughout length, vitta 4 shorter, broken on many specimens into an elongate anterior mark and a broad posterior spot usually connected to vitta 3 mesally; vitta 5 absent or represented by a small spot. Ventral surface black. Legs yellow.

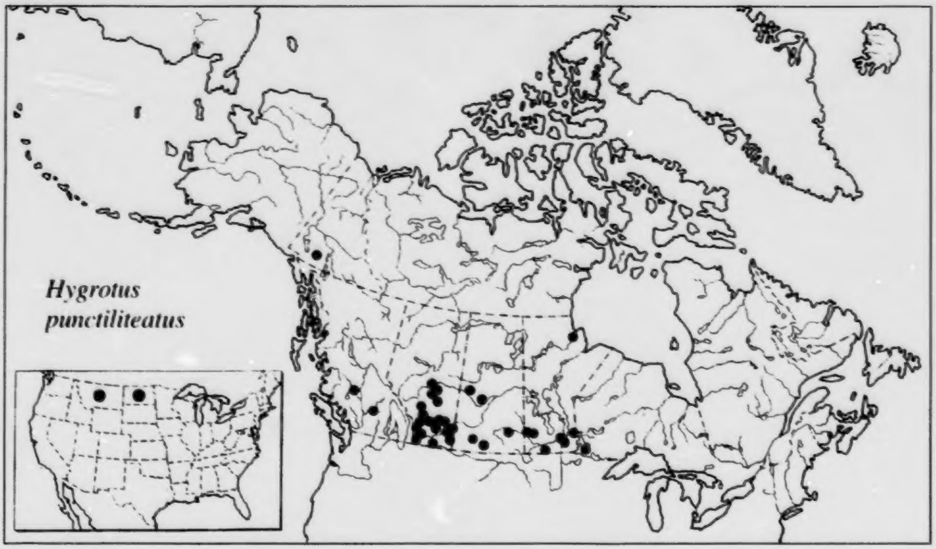
Head densely and deeply punctate. Elytron with punctation dual, with larger punctures subequal in size to serial punctures and situated mainly on vittae but also scattered over remainder of disc; interspaces with numerous very small punctures. Metasternal wing, metacoxal plate and sterna 1 to 3 with dense moderate sized punctures; sternum 6 with small dense punctures. Male elytron smooth and shiny, without microsculpture; female elytron with microsculpture which tends to obscure finer punctures; metacoxal plates and sterna sculptured on specimens of both sexes.

Clypeus without an anterior bead. Elytron with lateral margin strongly ascendant to humeral angle in lateral aspect. Prosternum with prominence obsolete to low but evident; prosternal process elongate and contacting metasternum. Abdomen with sterna not modified.

Male protarsus (Fig. 38C) broadly dilated; both protarsal claws modified, anterior claw (Fig. 38B) elongate and slender, more or less straight medially; posterior claw about one half length of anterior and very slender. Aedeagus (Fig. 38D) slender, evenly arcuate in lateral aspect except apex slightly recurved; paramere (Fig. 38E) with basal portion narrow and stalk-like, apical portion narrowly triangular.

Ecology. Specimens occur in alkaline or saline ponds. They are usually found where the substrate is largely clay or sand and vegetation is sparse.

Distribution. Map 50. This is principally a species of the northern prairies. The range extends from extreme southwestern Ontario to central British Columbia and north to the southern Yukon Territories.



Map 50. *Hygrotus punctilineatus* (Fall). Canadian and Alaskan collection localities and United States state records.

23. *Hygrotus semivittatus* (Fall 1919)

Fig. 39

Coelambus semivittatus Fall 1919: 18. Type locality - Seligman, Arizona.

Selected References. Larson 1975: 275; Anderson 1983: 188.

Description. Length = 4.0 to 4.9 mm; width = 2.2 to 2.5 mm; length: width = 1.92 to 2.08. Moderately large, elongate; habitus characteristic (Fig. 39A), pronotum narrow, lateral margins more or less straight and strongly discontinuous with elytra in dorsal aspect.

Head and pronotum rufotestaceous; antenna pale, infuscate apically; palpi yellow, with or without apical infuscation. Elytron testaceous except sutural margin narrowly piceous and disc with four narrow longitudinal vittae; vitta 2 best developed and extending medial two thirds of elytral length, vitta 1 slightly shorter with anterior origin slightly posterad of that of 2, vitta 3 with origin about middle of disc, vitta 4 various and usually consisting of one spot on apical half but on some specimens may extend more anterad (these markings may be varied, on some specimens almost absent while on others vittae may be well developed and variously coalescing towards apex). Ventral surface of body black.

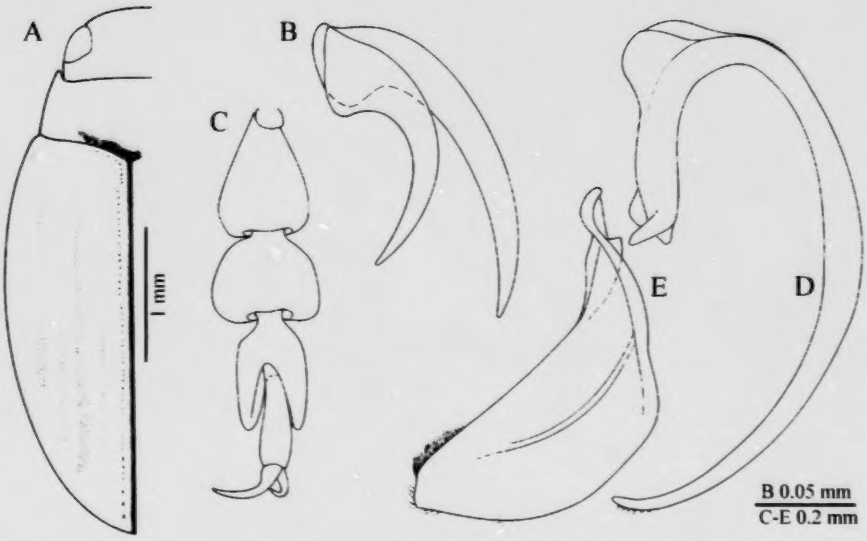


Fig. 39. *Hygrotus semivittatus*, male. A - body outline, B - protarsal claws anterior, C - protarsus, D - aedeagus lateral, E - paramere.

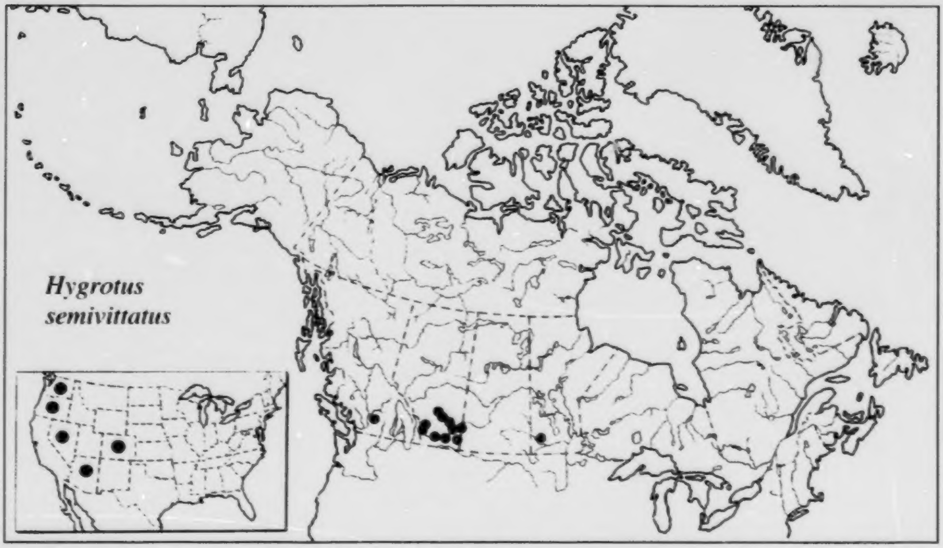
Elytron with punctation fine and of more or less uniform size and density. Ventral surface with punctures small, separate, entire metacoxal plate punctate but punctures sparser mesad; sternum 6 densely punctate, crowded medioapically and bearing elongate brown setae. Fine microreticulation present on elytra and metacoxal plates of both sexes but males shinier than females.

Clypeus lacking anterior marginal bead. Elytron with lateral margin strongly ascendant to humeral angle. Prosternal process short but sharply pointed apex extending between mesocoxae and contacting small flattened spot on metasternum; basal prominence a small acute spine between procoxae. Abdominal sterna not modified. Metatarsomere 1 with 3 to 6 ventral setae.

Male protarsus (Fig. 39C) dilated, protarsomere 2 broader than 1 which in turn is broader than 3; protarsal claws (Fig. 39B) slender, anterior claw shorter and more arcuate than posterior. Aedeagus (Fig. 39D) evenly arcuate in lateral aspect; paramere (Fig. 39E) triangular, basal portion short.

Ecology. This species occurs in saline or alkaline water. Beetles are usually found in shallow ponds which have a clay bottom and the water is often turbid. These ponds generally dry up by mid summer.

Distribution. Map 51. The range includes the southern Prairie Provinces, southern British Columbia and the Great Basin region of the United States south to Arizona.


Hygrotus
semivittatus

Map 51. *Hygrotus semivittatus* (Fall). Canadian and Alaskan collection localities and United States state records.

24. *Hygrotus tumidiventris* (Fall 1919)

Fig. 40

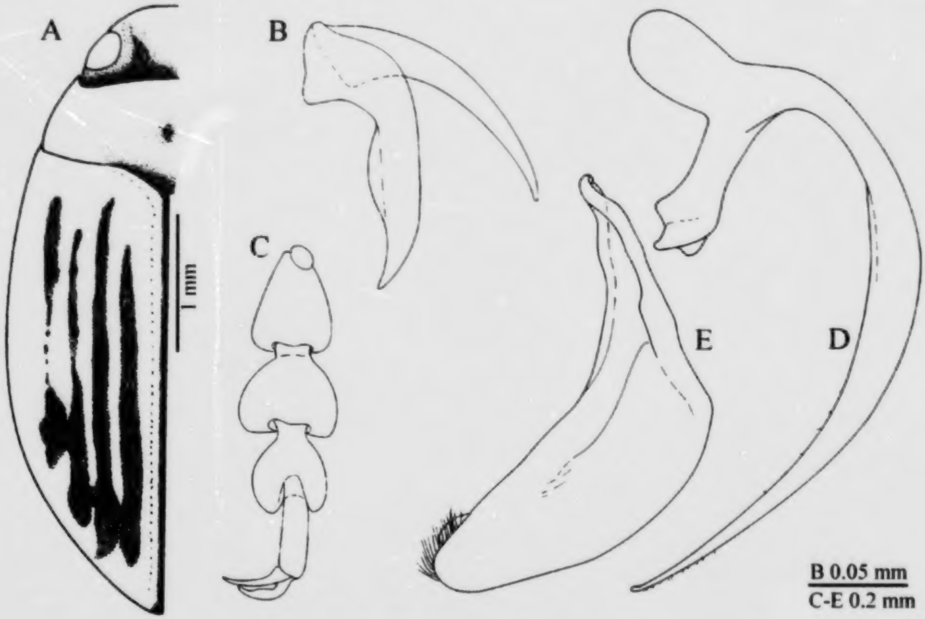

A
B
C
1 mm
E
D
B 0.05 mm
C-E 0.2 mm

Fig. 40. *Hygrotus tumidiventris*, male. A - body outline, B - protarsal claws anterior, C - protarsus, D - aedeagus lateral, E - paramere.

Coelambus tumidiventris Fall 1919: 16. Type locality - Stony Mountain, Manitoba.

Selected References. Larson 1975: 274; Anderson 1983: 186.

Description. Length = 4.1 to 4.9 mm; width = 2.0 to 2.6 mm; length: width = 1.85 to 2.00. Species of moderate size but with relatively large variation in length; body (Fig. 40A) elongate oval with slight discontinuity between pronotum and elytra..

Head reddish yellow except hind margin and frons mesad to each eye, dark brown to piceous, these dark areas contiguous on most specimens. Pronotum reddish yellow with anterior and posterior margins narrowly darkened near middle on some specimens, disc with a small brown medial spot. Elytron yellow to reddish yellow except sutural margin piceous and disc with distinctly vittiform maculations on most specimens, vittae 1 and 2 more or less complete and narrow, vitta 3 complete or broken in one or two places, vitta 4 broken at middle and vitta 5 represented as a small spot on apical half; vittae may be variously broadened and fused especially on apical portion of disc.

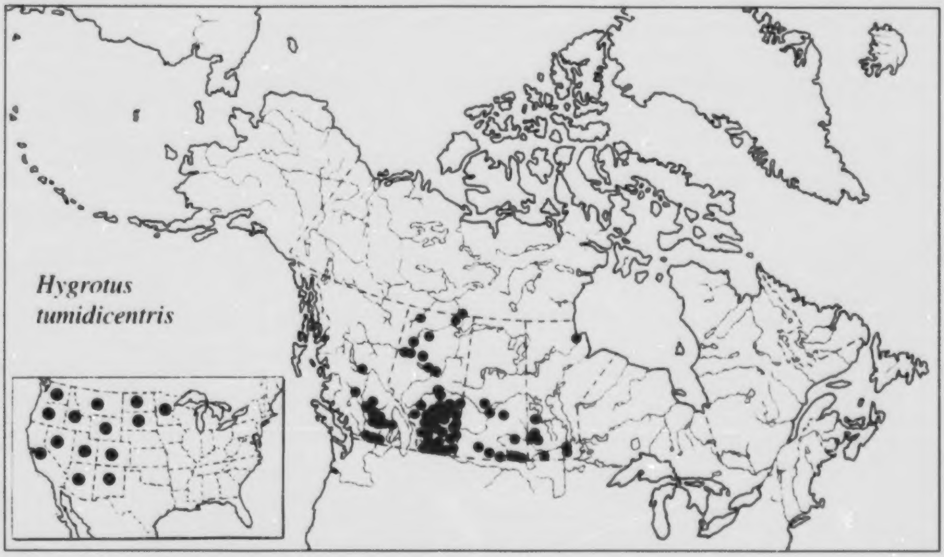
Elytron with punctation dual basally; larger punctures subequal in size to serial punctures, sparse and separated by more numerous smaller punctures. Ventral surface with moderately coarse punctures on metasternal wing, outer portions of metacoxal plate and laterally on abdominal sterna 1 and 2; sternum 6 with punctures various, punctation generally coarsest and densest on or behind lateral tumid areas, medial and apical areas sparsely punctate or impunctate. Male lacking microreticulation; female with fine microreticulation on elytra, metacoxal plates and sterna or some females with microreticulation reduced and male-like.

Clypeus lacking anterior bead. Elytron with lateral margin evenly arcuate in lateral aspect, epipleuron narrowly visible to shoulder. Prosternal process elongate and contacting metasternum; prominence obsolete. Sternum 6 modified, with a basolateral impression on each side followed by a pronounced swollen or tumid area (most pronounced on male).

Male with protarsomeres (Fig. 40C) 1 to 3 dilated, 1 and 3 subequal in width, 2 broader; protarsal claws (Fig. 40B) small, anterior slightly shorter than posterior, abruptly bent near base, ventrally broadened medially but without forming a distinct tooth; posterior claw not obviously modified. Aedeagus (Fig. 40D) evenly curved in lateral aspect, distinctly widened near middle; paramere (Fig. 40E) triangular with basal portion of moderate length.

Ecology. This species has been collected from both temporary and permanent ponds. Beetles occur in both fresh and saline waters but are most common in water of some mineral enrichment.

Distribution. Map 52. The range of *H. tumidiventris* extends from Manitoba to British Columbia and from the southwestern Northwest Territories south to northern New Mexico, Arizona and California.



Map 52. *Hygrotus tumidiventris* (Fall). Canadian and Alaskan collection localities and United States state records.

25. *Hygrotus unguicularis* (Crotch 1874)
Fig. 41

Hydroporus unguicularis Crotch 1874: 73–4. Type locality - British Columbia.

Selected References. Larson 1975: 273; Anderson 1983: 192.

Description. Length = 4.9 to 5.6 mm; width = 2.5 to 2.8 mm; length: width = 1.88 to 2.11. A large, elongate species.

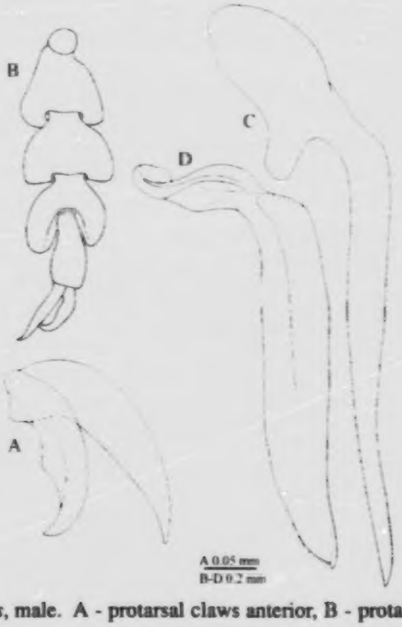


Fig. 41. *Hygrotus unguicularis*, male. A - protarsal claws anterior, B - protarsus, C - aedeagus lateral, D - paramere

Dorsal surface pale with darker markings. Head pale except posterior margin and on some specimens frons mesad to each eye, brown to piceous; antenna and palpi pale basally, infuscate apically. Pronotum testaceous, anterior and posterior margins translucent and appearing dark; disc with a small median piceous spot. Elytron testaceous with sutural margin narrowly black, disc with three more or less complete brown vittae, vitta 4 complete or broken medially, vitta 5 (submarginal) present only on apical half or absent; most specimens with vittae separate and distinct on basal half, variously widened and fused toward apex.

Elytron with punctures small, dense and of more or less even size, denser apically and on some specimens confluent to form traceable transverse series. Metasternal wing coarsely punctate; metacoxal plate with large punctures laterally, punctures becoming smaller and sparser medially; punctation of metacoxal plates and abdominal sterna finer than that of *H. infuscatus*; sternum 6 more or less evenly punctate. Male with elytra lacking microreticulation; female with entire disc densely reticulate; both sexes with ventral surface of body reticulate.

Clypeus without an anterior bead. Pronotum with sides arcuate, greatest width slightly anterior to obtuse, narrowly rounded hind angles. Prosternal process elongate and contacting metasternum; prominence obsolete. Sternum 6 not modified. Metatarsomere 1 with a longitudinal row of 7 to 12 setae on ventral face.

Male protarsomeres (Fig. 41B) 1 to 3 broadly dilated; protarsal claws broadened, anterior claw (Fig. 41A) shorter than posterior, with an obtuse ventral tooth, posterior claw twisted anteriorly in dorsal aspect. Aedeagus (Fig. 41C) large, in lateral aspect apical two thirds more or less straight; paramere (Fig. 41D) elongate and strap-like.

Ecology. The species occurs in a variety of habitats. Larson (1975) recorded it from warm, weedy ponds in Alberta, noting that it occurred primarily in fresh waters or waters of low salinity. In both the Yukon Territory and Labrador, specimens were collected from stands of emergent vegetation (*Scirpus* or *Juncus*) growing on sand along the margins of small lakes or along protected embayments of larger lakes.

Map 53. *Hygrotus unguicularis* (Crotch). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 53. This species is transcontinental, occurring from western Newfoundland to Alaska and south along the Rocky Mountains to Colorado.

26. *Hygrotus impressopunctatus* (Schaller 1783)

Fig. 42

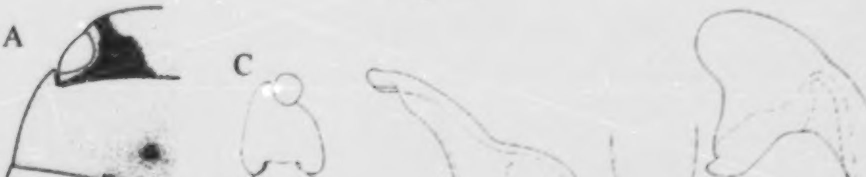


Fig. 42. *Hygrotus impressopunctatus*. A - body outline, B - male protarsal claws anterior, C - male protarsus, D - aedeagus lateral, E - aedeagus dorsal, F - paramere, G - female gonocoxa.

Dytiscus impressopunctatus Schaller 1783: 312. Type locality - not given.

Hydroporus similis Kirby 1837: 68. Type locality - North America.
(extensive Palaearctic synonymy given by Anderson 1983)

Selected References. Larson 1975: 276; Anderson 1983: 190; Hilsenhoff 1994: 282 – 283; Nilsson and Holmen 1995: 35.

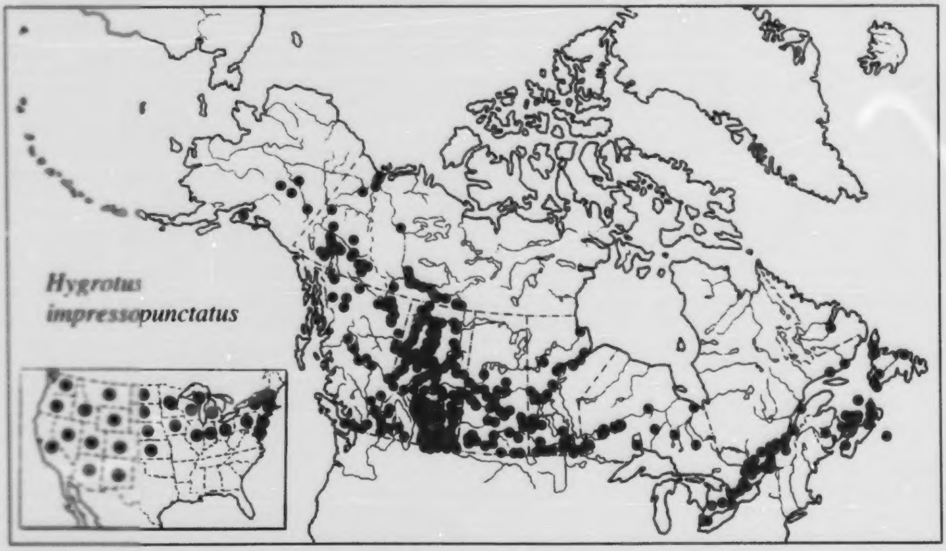
Description. Length = 4.4 to 5.4 mm; width = 2.2 to 2.6 mm; length: width = 1.85 to 2.00. Large, but size varied, body elongate oval (Fig. 42A).

Head rufous except frons mesad to each eye and posterior margin piceous, spots mesad to eyes convergent posteriorly and contacting dark hind margin of head; antenna yellow, infuscate apically; palpi yellow except maxillary palpus and some specimens also labial palpus lightly infuscate apically. Pronotum yellow to reddish with hind margin piceous along medial 0.33 to 0.5, dark area on some specimens narrowly extended laterally to hind angles and on some specimens anteriorly onto disc at middle. Elytron varied in color; disc largely dark brown or piceous with lateral and humeral areas pale as well as several, sometimes poorly defined, longitudinal vittae on disc (pale vittae evident on almost all specimens at least on disc just lateral to sutural margin and lateral to each row of serial punctures); epipleuron pale. Ventral surface mainly black. Legs reddish with pro- and mesotarsi infuscate on many specimens.

Elytron with punctation dual on basal half; each elytron with a subsutural, two discal and a subhumeral longitudinal row of closely situated or more or less longitudinally confluent serial punctures (these rows may not be evident on some densely microsculptured females); disc between serial punctures with scattered coarse punctures as well as more numerous small punctures, punctures denser and more regular on apex of elytron (punctation obscure on some densely sculptured females). Metasternal wing and metacoxal plate moderately coarsely punctate. Sternum 6 densely and evenly punctate. Male lacking microreticulation on elytron and abdominal sterna; metacoxal plates lightly sculptured. Females dimorphic, some lacking sculpture on elytra or with microreticulation restricted to apical third, metacoxal plates and sterna sculptured; other females with entire body densely microreticulate, these individuals with punctation fine and somewhat obscured and color pattern less distinct.

Clypeus without a bead on anterior margin. Prosternum with prominence small but distinct on most specimens; prosternal process normal, elongate and contacting metasternum.

Pro- and mesotarsus broadly dilated in both sexes (Fig. 42C). Male with protarsal claws (Fig. 42B) modified, anterior claw shorter, thicker and more strongly bent basally than posterior claw. Aedeagus (Fig. 42D, E) relatively short, apical two-thirds more or less straight in lateral aspect and more or less evenly narrowed to apex; paramere(Fig. 42F) rectangular apically. Female with gonocoxa of ovipositor (Fig. 42G) short and not produced into elongate, acute points.



Map 54. *Hygrotus impressopunctatus* (Schaller) Canadian and Alaskan collection localities and United States state records.

Ecology. This species is common in shallow, warm, vegetation rich margins of small ponds and pools. While it is not an evidently halophilic species over most of its range, it is absent or at least not common in oligotrophic habitats such as bogs (see below). The larval stages were described by Alarie *et al*. (1990).

Distribution. Map 54. The range is Holarctic. The species is widely distributed in Canada and Alaska south of the tree-line. However, within the boreal region and especially in bog habitats, it is relatively uncommon and is replaced by the similar species, *H. picatus*. In Atlantic Canada the species is found primarily along the sea coast and is somewhat halophilic or at least occurs in habitats that have some marine enrichment (Larson and Colbo 1983). In the mid-continent the species is not evidently halophilic but specimens are taken frequently in evidently saline ponds.

27. *Hygrotus picatus* (Kirby 1837)

Fig. 43

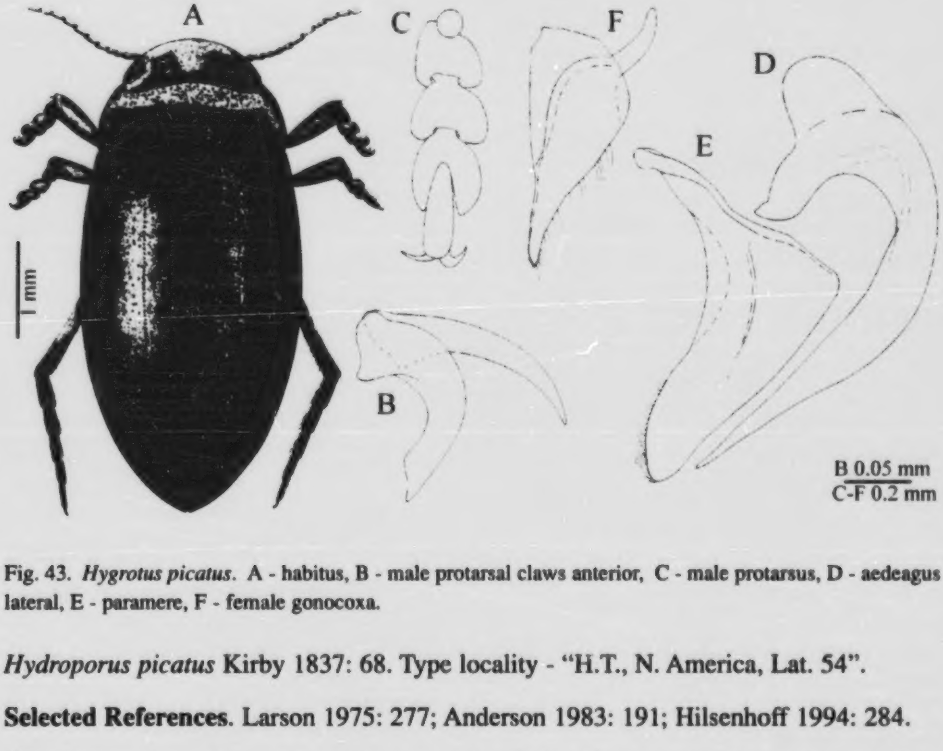


Fig. 43. *Hygrotus picatus*. A - habitus, B - male protarsal claws anterior, C - male protarsus, D - aedeagus lateral, E - paramere, F - female gonocoxa.

Hydroporus picatus Kirby 1837: 68. Type locality - "H.T., N. America, Lat. 54".

Selected References. Larson 1975: 277; Anderson 1983: 191; Hilsenhoff 1994: 284.

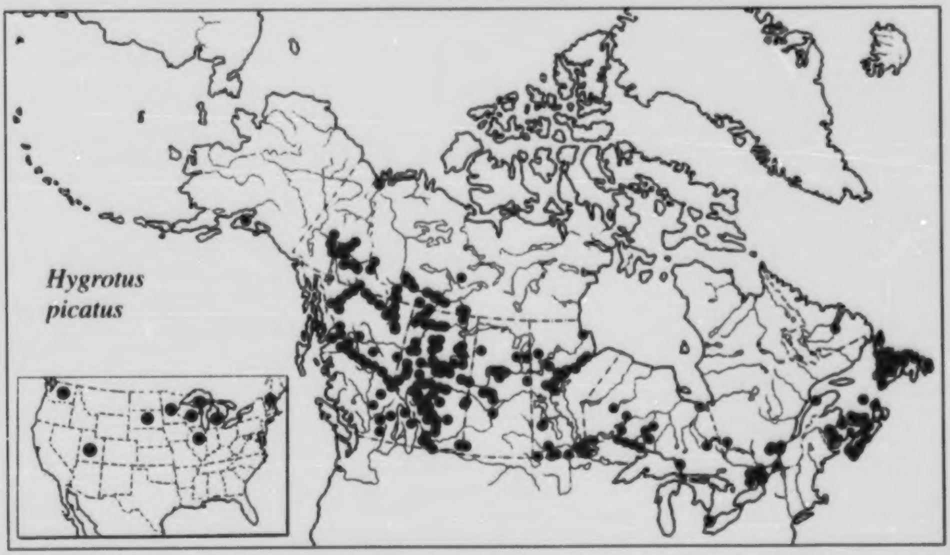
Description. Length = 4.7 to 5.5 mm; width = 2.4 to 2.7 mm; length: width = 1.89 to 2.02. A large species; body (Fig. 43A) elongate oval, pronotum relatively broad and more arcuate in outline than elytra at base so that outline of body is somewhat discontinuous.

Head rufous with hind margin and a broad area on frons mesad to each eye, piceous; antenna pale, infuscate apically; palpi pale, maxillary palpus lightly infuscate in many specimens, labial palpus entirely pale on most specimens. Pronotum with apical half rufous, base with a broad piceous band which reaches lateral angle on most specimens. Elytron uniformly dark rufous to brown, without suggestion of longitudinal pale markings. Ventral surface black. Legs rufous, metafemur medially and tarsi infuscate on some specimens.

Pronotum with numerous coarse and often somewhat elongate punctures on basal half (dark areas), punctures less numerous anteriorly; interspaces with scattered fine punctures. Elytra with dense coarse punctures; serial punctures slightly smaller than discal punctures and more or less longitudinally confluent basally to form a subsutural, two discal and a subhumeral longitudinal impressions or striae; interspaces between coarse punctures with numerous very fine punctures. Metasternal wing and metacoxal plate coarsely punctate; sternum 1 and 2 with punctures slightly smaller. Sternum 6 with more or less evenly distributed punctures. Male with pronotum medially and disc of elytron shiny, without microreticulation; metacoxal plate microreticulate; abdominal sterna shiny but with lightly impressed microreticulation which is visible even on posteromedial portions of sternum 3. Females dimorphic in sculpture, either male-like with abdominal microreticulation better developed, or entire body densely microreticulate and dull (punctation shallower on such dull females, serial punctures less conspicuous and on many specimens not forming evident longitudinal impressions).

Clypeus lacking anterior bead. Prosternal process elongate and contacting metasternum; prominence obsolete or small. Abdominal sterna not modified in either sex.

Male protarsus (Fig. 43C) broadly dilated; anterior claw (Fig. 43B) shorter, broader and more strongly arcuate than unmodified posterior claw. Aedeagus (Fig. 43D) elongate, more or less straight in apical two thirds, slightly broader medially than that of *H. impressopunctatus*; paramere (Fig. 43E) more triangular in shape than *H. impressopunctatus*. Female ovipositor (Fig. 43F) with apex of gonocoxa elongate



Map 55. *Hygrotus picatus* (Kirby). Canadian and Alaskan collection localities and United States state records.

Ecology. The habitat of this species is somewhat unusual for a species of *Hygrotus*. Specimens usually occur among dense vegetation in densely shaded, often cold, water. They are often in association with sphagnum moss and in boreal *Carex* marshes. The larval stages were described by Alarie *et al*. (1990).

Distribution. Map 55. This species occurs throughout the boreal region, from Newfoundland to British Columbia and Alaska and south to Illinois and Utah.

28. *Hygrotus masculinus* (Crotch 1874)

Fig. 44

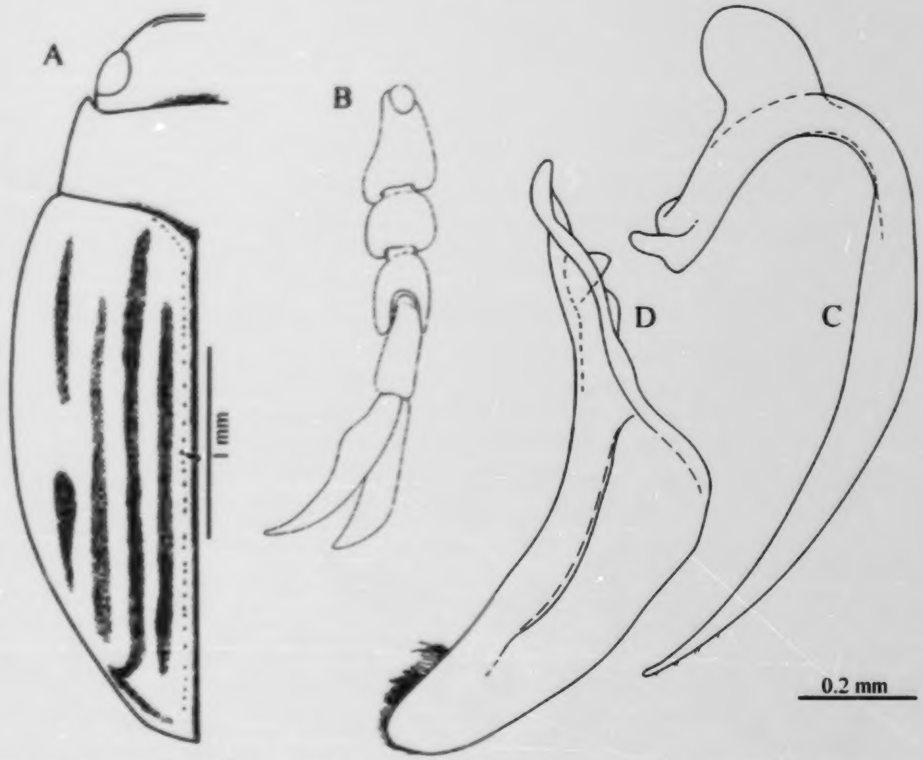


Fig. 44. *Hygrotus masculinus* (Crotch). A - body outline. B - male protarsus. C - aedeagus. lateral aspect. D - paramere.

Hydroporus masculinus Crotch 1874: 74. Type locality - Lake la Hache, British Columbia (Anderson 1983).

Selected References. Larson 1975: 278; Anderson 1983: 185.

Description. Length = 3.7 to 4.7 mm; width = 1.9 to 2.4 mm; length: width = 1.89 to 1.97. Body (Fig. 44A) ovate, slightly to distinctly discontinuous in outline in dorsal aspect.

Head reddish yellow except for a short piceous band along posteromedial margin; antenna yellow, infuscate apically; palpi yellow. Pronotum yellow to reddish yellow, without a medial discal spot. Elytron yellow with sutural margin narrowly piceous, disc with four brown to piceous longitudinal vittae, vittae 1 to 3 complete, vitta 4 broken medially on many specimens. Ventral surface mainly black.

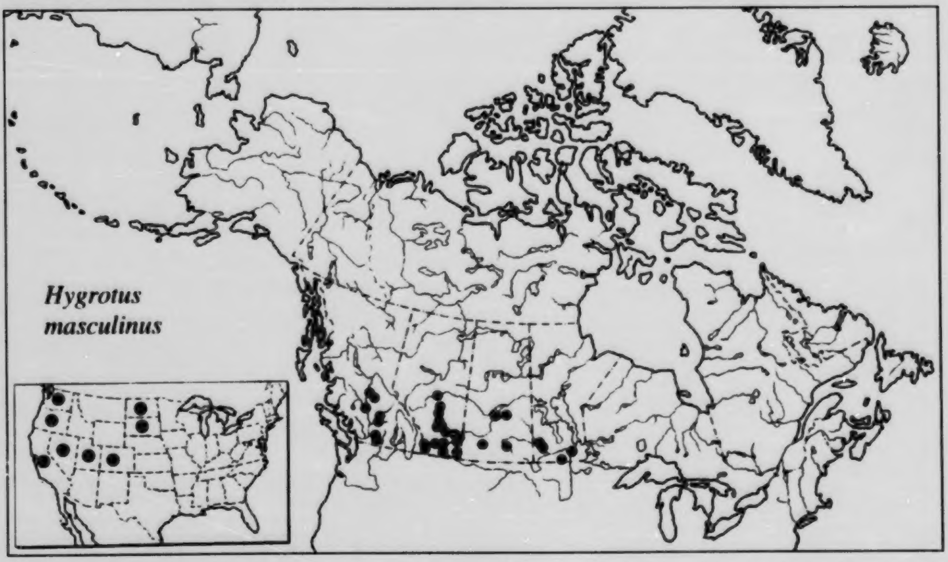
Elytra with dense small punctures and less abundant slightly larger punctures; epipleuron very finely and densely punctate. Ventral surface with punctation fine, especially on metacoxal plate. Sternum 6 densely and evenly punctate. Male shiny, without microreticulation on elytra but metacoxal plates and abdominal sterna sculptured. Female microreticulate on elytra and ventral surface.

Clypeus with an anterior marginal bead. Pronotum with sides more or less straight or only slightly arcuate, diverging behind but base of pronotum slightly narrower than width of elytra across shoulders therefore body outline discontinuous in dorsal aspect; posterolateral angle of pronotum acute. Elytron in lateral aspect with lateral margin strongly ascendant to humeral angle. Prosternum with prominence small but evident as a low angulation or spine; prosternal process short and rounded, bluntly pointed apically and not contacting metasternum; mesocoxae contiguous. Metatarsomere 1 with a row of setae running length of ventral surface, apicomesal angle produced and subequal in length to lateral setae.

Male protarsus (Fig. 44B) with protarsomeres 1 to 3 only slightly dilated; protarsal claws (Fig. 44B) greatly elongate and dosoventrally flattened, anterior claw slightly shorter than posterior and broader and more rounded apically. Aedeagus (Fig. 44C) elongate, evenly arcuate in lateral aspect; paramere (Fig. 44D) with apical setae on mesal face divided into two patches.

Ecology. This species occurs in shallow, mud or clay bottomed saline ponds and lakes. Teneral specimens have been collected from the end of May to August. The larval stages were described by Alarie *et al.* (1990).

Distribution. Map 56. The range extends from southern Manitoba to southern British Columbia and south to Colorado and California.



Map 56. *Hygrotus masculinus* (Crotch). Canadian and Alaskan collection localities and United States state records.

29. *Hygrotus salinarius* (Wallis 1924)

Fig. 45

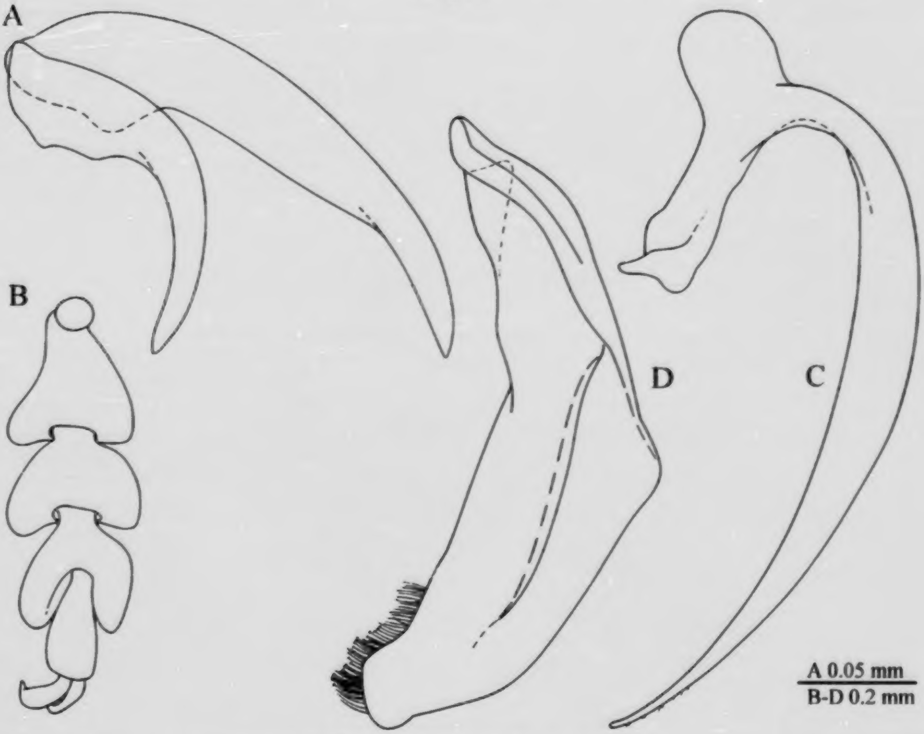


Fig. 45. *Hygrotus salinarius* (Wallis). A - male protarsal claws, anterior aspect. B - male protarsus. C - aedeagus. lateral aspect. D - paramere.

Coelambus salinarius Wallis 1924: 105–7. Type locality - Cobb's Lake, Baldur, Manitoba.

Selected References. Larson 1975: 278; Anderson 1983: 186.

Description. Length = 3.6 to 5.2 mm; width = 2.2 to 2.5 mm; length: width = 1.89 to 2.04. Very similar in form and habits to *H. masculinus* and best recognized on basis of male tarsal characters.

Head reddish yellow, most specimens without a posteromedial spot; antenna yellow, infuscate apically; palpi yellow. Pronotum entirely reddish yellow. Elytron testaceous with sutural margin narrowly piceous and disc with four brown to piceous longitudinal vittae, vittae 1 to 3 usually complete and vitta 4 broken medially on most specimens. Ventral surface mainly black.

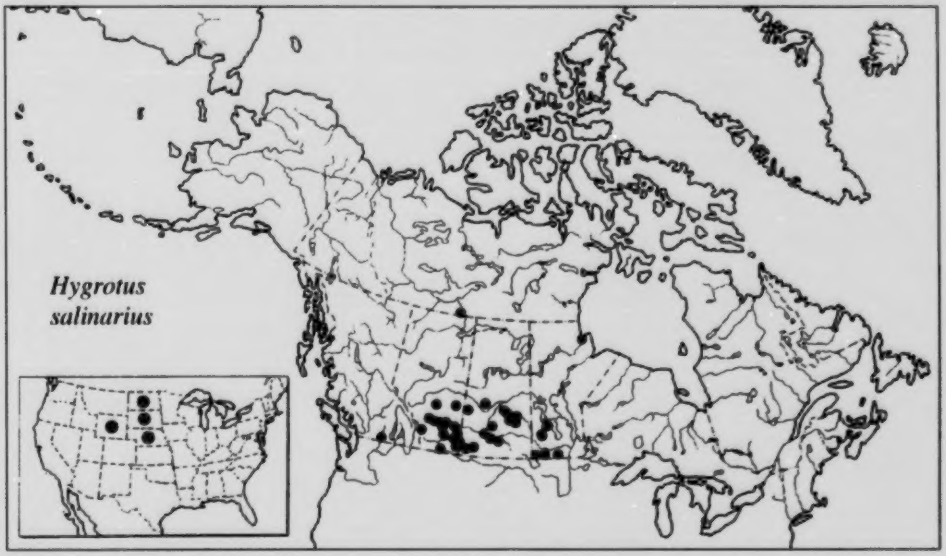
Elytron with dense, fine punctures and sparser larger punctures but punctation not evidently dual; epipleuron very finely and densely punctate. Punctures of ventral surface distinct but relatively small, best developed laterally on metasternal wing and metacoxal plate, sparser and smaller or obsolete medially. Sternum 6 densely and more or less evenly punctate. Male with elytra shiny, without microreticulation; female elytra microreticulate; both sexes with ventral surface of body microreticulate.

Clypeus with an anterior marginal bead. Elytron more obliquely ascendant to humeral angle than in *H. masculinus*. Prosternum with prominence small but acute and evident; prosternal process short and broad, not contacting metasternum and mesocoxae contiguous medially. Metatarsomere 1 with a row of short setae running length of ventral surface, mesoapical angle produced but much shorter than lateral setae.

Male protarsus (Fig. 45B) broadly dilated; protarsal claws modified, anterior claw (Fig. 45A) shorter than posterior, narrower and more strongly arcuate, posterior claw twisted anteriorly when viewed from above. Aedeagus (Fig. 45C) slightly curved in lateral aspect; paramere (Fig. 45D) with a single patch of apical setae on mesal face.

Ecology This species occurs only in saline waters. Tones (1978) found that adults can maintain their haemolymph hyposmotic to a highly saline medium and their urine is hyperosmotic to both the haemolymph and the medium. Larvae also tolerate a wide range of salinities, regulating their haemolymph hyperosmotically in dilute media but becoming isosmotic in water of higher salt concentrations. Specimens have been found in turbid, clay bottomed ponds as well as in the clear water of sandy or gravel bottomed lakes. An unusual collection was that of a series of teneral specimens swept from grass several metres back from the edge of the water, Lakeside, Nebraska (26 July, CARR). Possibly the insects were preparing to disperse by flight from their pupal sites.

Distribution. Map 57. Most collection records are from the northern Great Plains but specimens have also been seen from northern Manitoba, southern Northwest Territories and west of the continental divide in southern British Columbia.



Map 57. *Hygrotus salinarius* (Wallis). Canadian and Alaskan collection localities and United States state records.

Genus *Sanfilippodytes* Franciscolo 1979
Figs. 23D; 46 – 48

Hydroporus vilis-group sensu Fall 1923: 54 – 60.

Sanfilippodytes Franciscolo 1979: 233. Type species - *Sanfilippodytes sbordonii* Franciscolo 1979, by original designation.

Diagnosis. Nearctic specimens small, length = 2.1 to 4.3 mm. Shape evenly elongate to oval in dorsal aspect; moderately convex to distinctly flattened, in lateral aspect. Color pale brown to piceous; many specimens with pronotal disc darker than elytra, some specimens with elytra distinctly bicolored; ventral surface mainly black with variously developed reddish areas on abdomen laterally. Dorsal surface microreticulate and finely punctate, setae sparse and inconspicuous. Sculpture various, males relatively shiny, females similar to male or with microreticulation slightly more impressed and surface duller.

Head broad with eyes relatively small; antenna not modified (most species) to subserrate; clypeus with anterior margin unmodified. Pronotum, in dorsal aspect, narrowed anteriorly and as wide as elytra basally; lateral bead narrow to broad; disk without a sublateral longitudinal crease or line on each side. Elytron, in lateral aspect, with lateral margin straight or gently ascendant towards humeral angle, epipleuron visible to or almost to shoulder; without a carina crossing epipleuron at humeral angle. Prosternum gently declivitous but file and prominence weakly expressed to obsolete; prosternal process bluntly pointed apically, small, shape ovate to elongate and medially weakly convex to excavate and with or without a well developed medial ridge or carina. Metasternum not sulcate medially. Metacoxal processes (Fig. 23D) conjointly with hind margin sinuate, emarginate each side of medial line and apex produced along medial line; lateral lobe covering base of metatrochanter, metafemur not touching metacoxal lobe. Metatrochanter (Fig. 23D) enlarged and elongate in most species, length of metafemur along dorsal margin (anterior margin): length of metatrochanter along its ventral margin (posterior margin) = 1.70 to 2.44; most species with a ratio less than 2.1 and species with ratio more than 2.1 with pronotal bead very broad and wider than a median antennomere. Females of some species with last visible sternum (sternum 6) variously modified.

Male protibia without a basovental emargination. Male protarsus slightly dilated, pro- and mesotarsomere 1 with three pairs of scales; pro- and mesotarsomere 1 with two pairs of large round scales and pro- and mesotarsomere 2 with one pair of round scales. Aedeagus shape various (Figs. 46 – 48), from relatively evenly curved in some species to narrowly bisected apically in a few species to complexly expanded with a distinct notch apically. Parameres (Fig. 48M) broadly triangular, subequal in length to aedeagus.

Female with pro- and mesotarsomeres slender, apical tarsomere slender and subequal in length to basal three tarsomeres. Ovipositor with gonocoxa elongate, cylindrical and lightly sclerotized, with at most short, sparse setae; apex rounded with a stout spine.

Comments. *Sanfilippodytes* represents the *Hydroporus vilis*-group of Fall (1923). As presently defined it is exclusively Nearctic and ranges collectively from Alaska to Mexico. The type species, *Sanfilippodytes sbdornii* Franciscolo, was described from a cave in Mexico and Franciscolo (1979*b*, 1983) has maintained that this is a troglodytic species. The holotype and various topotypical specimens were examined by R. E. Roughley and they represent typical members of the *Hydroporus vilis*-group as defined by Fall (1923). Thus it appears advisable to use the available name *Sanfilippodytes* for the Nearctic *Hydroporus vilis*-group as was suggested by Rochette (1983b), Roughley and Larson (1991) and Larson and LaBonte (1994).

The taxonomy of species of *Sanfilippodytes* is extremely difficult. Rochette (1983 *a*, 1983*b*, 1983*c*, 1985, 1986) described new species and provided a list of 24 available names within the group. This genus is in need of a thorough revision as examination of a number of large collections suggests that there are additional species to be described and it will take time to assess the amount of variation within the group. The essential problem is that the species are best characterized by very subtle differences in the form of the aedeagus. Because the members of these species tend to be restricted to cold stenothermal habitats (particularly springs), they probably do not disperse very often or very far. Adjacent populations appear similar in body form and punctation but often they are just different enough to cause doubt about whether they are conspecific. The separation of species level variation from population level variation will require much further work and study. Therefore it should be clear that the names used below are provided provisionally. In Canada and Alaska the nomenclature of these species is less complex and therefore we are confident about the number and distinction among species, if not the nomenclature.

The form of the aedeagus is quite complex among the members of *Sanfilippodytes* and some terms are used rather precisely in the description of the form of the aedeagus of these species. The relative width of the aedeagus, in lateral aspect, varies from narrow to quite broad and thick, in dorsal view the channel through which the spermatophore passes is quite broad and of uniform thickness or it is narrowed either anteriorly or posteriorly; on either side of this channel are dorsal flanges which are absent, low and inconspicuous to high and prominent distally. When the aedeagus is rotated into lateral aspect the degree of development and the shape of the most distal part of these dorsal flanges provides important distinguishing features. The aedeagus has the distal portion expanded (apical blade) and this should be viewed dorsally, ventrally and laterally. In dorsal aspect the form of the outer edge of the apical blade should be noted; this is the angle of formation of the apical blade which ranges in shape from gently curving outward, smoothly rounded to angulate laterally. Also the point of maximum width of the apical blade differs between species. Mediodistally on the aedeagus is the apical notch and the size, depth and shape of the notch are useful taxonomic features.

The genus *Sanfilippodytes* is composed of three main species groups based on a number of structural features as well as the form of the male aedeagus. The *Sanfilippodytes terminalis-* group [*S. terminalis* (Sharp*)*, *S. veronicae* (Rochette), *S. corvallis* (Fall), *S. barbarae* (Fall), *S. adelardi* (Rochette), and *S. bidessoides* (Leech)] appears to form a monophyletic unit. They are characterized by a small metatrochanter (ratio of length of posterior margin of metatrochanter: dorsal length of metafemur = 2.1 or more (except *S. veronicae* = 2.26 to 2.0), pronotal bead very wide (wider than a medial antennomere), and the aedeagus differentiated in lateral and dorsal aspect (except *S. adelardi*) and with the extreme apex entire (except *S. corvallis, S. barbarae* and *S. adelardi*). All of these species are found in western North America from British Columbia south to California. Leech (1941*a)* implied that this set of species probably deserved a separate and distinct genus and that they were not truly members of the *H. vilis*-group as they do not possess an apically notched aedeagus. Presently it seems more appropriate to include all of these species within *Sanfilippodytes* as there is a transformation series in the form of the apex of the aedeagus and other characters within the genus.

Two other species groups are recognized within the genus. These are the *S. pacificus* - group and the *S. vilis*-group. Both groups have a large metatrochanter (ratio of length of metafemur: length of metatrochanter less than 2.1), pronotal bead narrow (narrower than a medial antennomere), and the extreme apex of the aedeagus is highly differentiated with a broad excision or notch at the apex (apical notch). The members of the S. pacificus-group [*S. pacificus* (Fall), and *S. rossi* (Leech)] are characterized by the aedeagus, in dorsal or ventral profile, being gradually widened subapically and, in lateral profile, by an undifferentiated apical area (without an apical blade). The members of the *S. vilis*-group [*S. bertae* n.sp., *S. barbarensis* (Wallis), *S. belfragei* (Sharp), *S. compertus* (Brown), *S. edwardsi* (Wallis), *S. hardyi* (Sharp), *S. kingi* (Clark), *S. latebrosus* (LeConte), *S. malkini* (Hatch), *S. planiusculus* (Fall), *S. pseudovilis* (Young), *S. sbordonii* (Franciscolo), *S. setifer* n.sp.and *S. vilis* (LeConte)] are characterized by the aedeagus, in dorsal or ventral profile, being abruptly widened subapically (with an apical blade) and, in lateral profile, by a highly differentiated apical area (except *S. bertae*, and *S. hardyi*). The species of both the *S. vilis*- and *S. pacificus*-groups are found west of the 100th meridian in North America (except for the transcontinental *S. pseudovilis* and the exclusively eastern *S. planiusculus* and *S. brumalis*).

The species of this genus occur in a moderate array of habitats. They are known from caves (type species); many specimens are taken from interstitial spaces among gravel and stones along margins of springs, creeks and rivers or they are collected sweeping a net over clay to sand-clay or gravel substrate of cold springs and small creeks. They have been collected from deep within the sand of small sand-bottom streams; they inhabit limnocrene pools of springs, and have been observed to be common among mosses in springs and seeps; they have been collected under cover and beach debris along the margins of alpine and subalpine lakes.

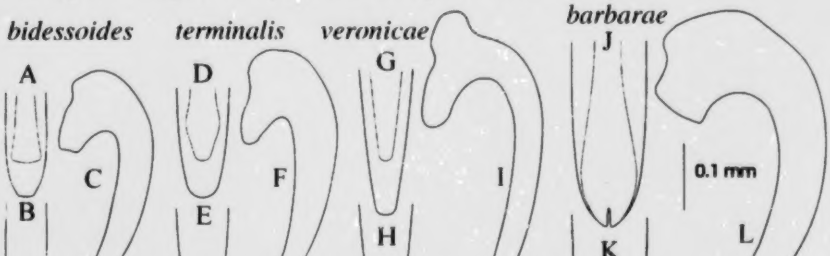


Fig. 46. ***Sanfilippodytes, S. terminalis*-group. Male aedeagus. A – C - *S. bidessoides*, A - dorsal, B - ventral, C - lateral. D – F - *S. terminalis*, D - dorsal, E - ventral, F - lateral. G – I - *S. veronicae*, G - dorsal, H - ventral, I - lateral. J – L - *S. barbarae*, J - dorsal, K - ventral, L - lateral. M – N - *S. curvellis*, M - ventral, N - lateral. O – Q - *S. adelardi*, O - dorsal, P - ventral, Q - lateral.**

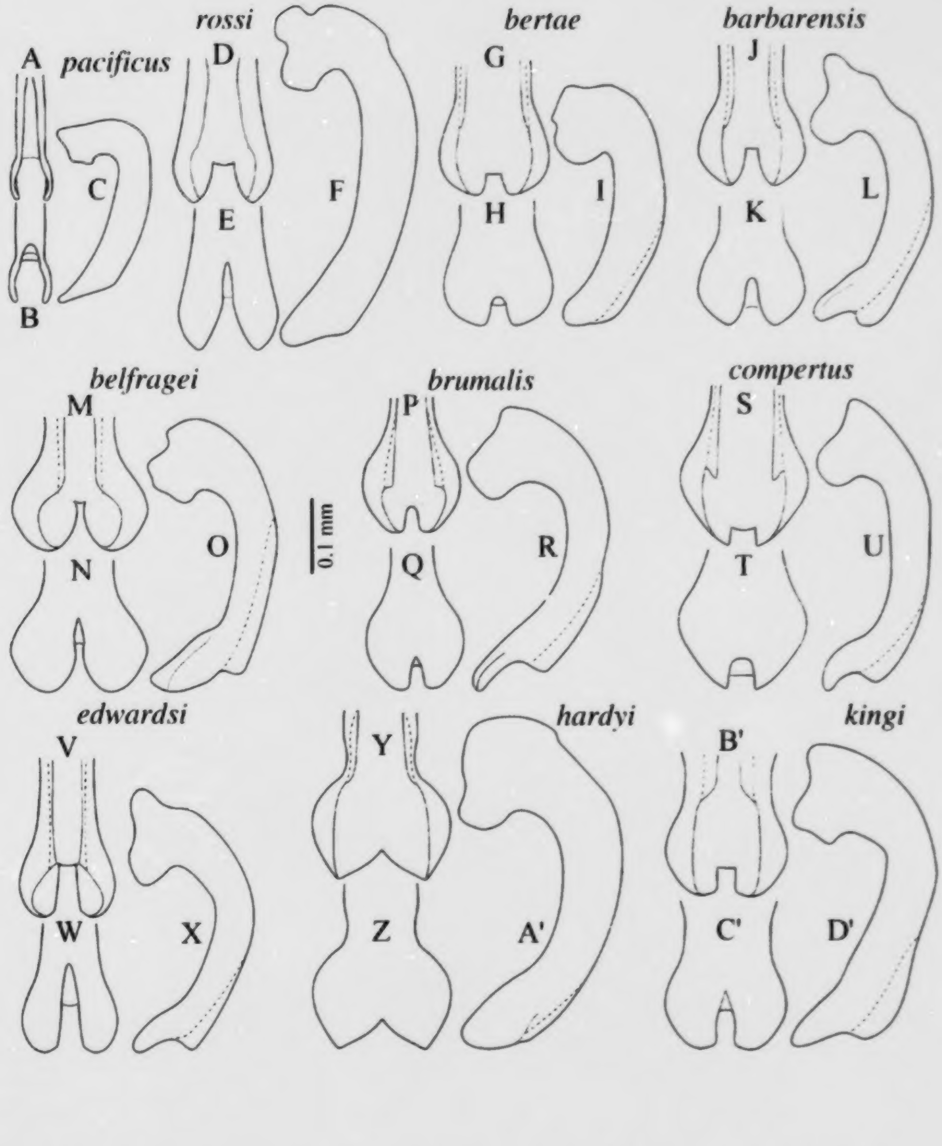

rossi
bertae
barbarensis
A
pacificus
D
G
J
C
E
F
H
I
K
L
B
belfragei
brumalis
compertus
M
P
S
0.1 mm
O
N
R
Q
U
T
edwardsi
hardyi
kingi
V
Y
B'
W
X
Z
A'
C'
D'

Fig. 47. *Sanfilippodytes*, *S. pacificus*-group and *S. vilis*-group (in part). Male aedeagus. A – C - *S. pacificus*, A - dorsal, B - ventral, C - lateral. G – I - *S. bertae*, G - dorsal, H - ventral, I - lateral. J – L - *S. barbarensis*, J - dorsal, K - ventral, L - lateral. M – O - *S. belfragei*, M - dorsal, N - ventral, O - lateral. P – R - *S. brumalis*, P - dorsal, Q - ventral, R - lateral. S – U - *S. compertus*, S - dorsal, T - ventral, U - lateral. V – X - *S. edwardsi*, V - dorsal, W - ventral, X - lateral. Y – A' - *S. hardyi*, Y - dorsal, Z - ventral, A' - lateral. B' – D' - *S. kingi*, B' - dosal, C' - ventral, D' - lateral.

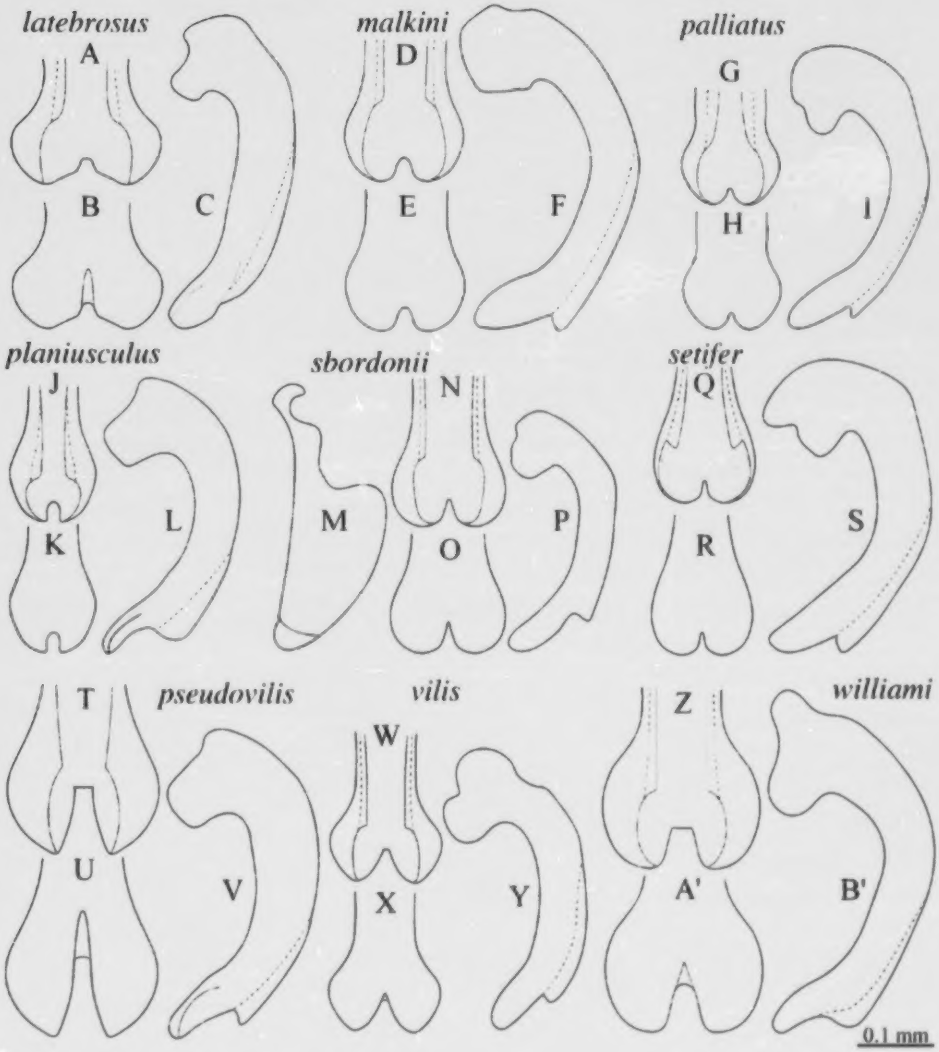

latebrosus
A
B
C
malkini
D
E
F
palliatus
G
H
I
planiusculus
J
K
L
sbordonii
M
N
O
P
setifer
Q
R
S
T
U
pseudovilis
V
vilis
W
X
Y
Z
A'
williami
B'
0.1 mm

Fig. 48. *Sanfilippodytes*, *S. vilis*-group (in part). Male genitalia. A – C - *S. latebrosus*, A - dorsal, B - ventral, C - lateral. D – F - *S. malkini*, D - dorsal, E - ventral, F - lateral. G – I - *S. palliatus*, G - dorsal, H - ventral, I - lateral. J – L - *S. planiusculus*, J - dorsal, K - ventral, L - lateral. M – P - *S. sbordonii*, M - paramere, N - aedeagus dorsal, O - ventral, P - lateral. Q – S - *S. setifer*, Q - dorsal, R - ventral, S - lateral. T – V - *S. pseudovilis*, T - dorsal, U - ventral, V - lateral. W – Y - *S. vilis*, W - dorsal, X - ventral, Y - lateral. Z – B' - *S. williami*, Z - dorsal, A' - ventral, B' - lateral.

Key to described species of *Sanfilippodytes* Franciscolo

(Aedeagus illustrations in Figs. 46 – 48)

1. Pronotal bead broad, subequal in width to a median antennomere; metacoxal lines slightly but distinctly reflexed toward midline anterior to metacoxal processes, metacoxal lines distinctly diverging proximally; metatrochanter shorter, most specimens with ratio of length of metafemur: length of metatrochanter = 2.1 or greater; body form narrower and more convex; most species with male aedeagus with apex simple 2

1'. Pronotal bead narrower, not as wide as a median antennomere; metacoxal lines more widely separated anterior to metacoxal processes, metacoxal lines almost parallel or diverging only slightly proximally; metatrochanter longer, ratio of length metafemur: length of metatrochanter less than 2.1; body broader and more depressed; male aedeagus with apex variously expanded 7

2(1). Smaller specimens, length less than 3.8 mm; prosternal process blade without medial convexity 3

2'. Larger specimens, length = 4.0 to 4.33 mm; prosternal process blade with medial convexity extended to apex; width = 1.9 to 2.04 mm, length: width = 2.05 to 2.11; head, pronotum and elytra light reddish brown; aedeagus, in dorsal aspect, with apical incision and apical lobes narrowly but distinctly separated (Fig. 46M, N); Oregon . . . . .1. *S. corvallis* (Fall)

3(2). Head and pronotum pale golden brown with elytra only slightly darker; male with pro- and mesotarsal claws very long, protarsus, in lateral aspect, with longer claw equal or subequal to length of exposed portion of protarsomere 5; aedeagus, in dorsal aspect, with apical incision narrow and with apical lobes not distinctly separated (Fig. 46J – L); length = 3.04 to 3.20 mm, width = 1.52 to 1.64 mm, length: width= 1.88 to 2.03; southern California north to San Francisco . . . . *S. barbarae* (Fall 1932)

3'. Head, disc of pronotum OR elytra medially darker, dark reddish brown; male with protarsal claw shorter; protarsus with longer claw less than 0.5 length of exposed portion of protarsomere 5, in lateral aspect; aedeagus, in dorsal aspect, with or without apical, longitudinal incision 4

4.(3) Larger specimens, length 3.1 to3.5 mm; body form more depressed; antenna uniformly pale yellow; male with apex of aedeagus notched and with enlarged elongate dorsal flanges extending past ventral apex (Fig. 46O – Q); head reddish, pronotum dark reddish brown and elytra reddish brown; width = 1.5 to 1.7 mm; length: width = 1.95 to 2.08; California (Mendocino Co.) . . . . *S. adelardi* (Rochette 1983)

4'. Smaller specimens, length less than 3.0 mm; antenna apically infuscate; body form distinctly convex; male with apex of aedeagus simple and entire and without an apical notch or dorsal flanges 5

5(4). Smaller specimens, length = 2.1 to 2.5 mm; metatarsus with apical segment elongate, metatarsomere 5 longer than metatarsomere 1; aedeagus, in dorsal aspect, with apex acute, and in lateral view, with tip in line with axis of more basal portion(Fig. 46A – C); head, pronotum and elytra dark brown; width = 1.04 to 1.22 mm; length: width = 1.97 to 2.10; California (Mendocino Co.) . . . . . .*S. bidessoides* (Leech 1941*a*)

5'. Larger specimens, length greater than 2.5 mm; metatarsus with apical segment shorter, metatarsomere 5 shorter than metatarsomere 1; aedeagus, in dorsal aspect, with apex broadly rounded or truncate, and in lateral view with tip reflexed ventrally from axis of more basal portion 6

6(5). Pronotal bead distinctly and evenly narrowed posteriorly; male with protarsal claws longer; elytron less coarsely punctate; body shape more elongate oval; most specimens with head and pronotum darker reddish brown and elytra yellowish brown; aedeagus, in dorsal aspect, narrow (Fig. 46G – I); length = 2.56 to 2.80 mm, width = 1.32 to 1.48 mm, length: width = 1.85 to 1.97; California (Tulare Co. north to Humboldt and Shasta Co.) . . . .*S. veronicae* (Rochette 1983)

6'. Pronotal bead uniformly wide throughout its length; male with protarsal claws shorter; elytron more coarsely punctate; body shape more evenly oval; head and pronotum reddish brownish, elytra yellowish brown to brownish red; aedeagus with apex broadly rounded, in dorsal aspect (Fig. 46D – F); length = 2.50 to 2.90 mm, width = 1.28 to 1.42 mm; length: width =1.91 to 2.05; British Columbia south to California . . . . .2. *S. terminalis* (Sharp)

7(1'). Female with apex of last visible sternum modified, in lateral aspect, sinuate and slightly but evidently reflexed downward at apex; prosternal process of most specimens with a low but distinct medial convexity on apical two-thirds 8

7'. Female with apex of last visible sternum not modified, in lateral aspect, evenly curved to apex; prosternal process medial convexity, if present, visible only on apical half (except *S. barbarensis*, *S. hardyi* and *S. kingi*, see couplet 18) 13

8(7). Female with apex of last visible sternum, in ventral or posterior aspect, produced posteriorly as an apical lobe (small in *S. pacificus*); male with aedeagus gradually widened to form apical blade; elytron finely punctate; head reddish-yellow, pronotum black with side margins narrowly reddish, elytra yellowish to yellowish brown 9

8'. Female with apex of last sternum, in ventral or posterior aspect, rounded; male with aedeagus more abruptly widened subapically to form apical blade; elytron with punctation various; body color various 10

9(8). Area between metacoxal lines flat, without microsculpture but with scattered very fine punctures; prosternal process with blade short and broad with apex reflexed downward; female with lobe on last visible sternum elongate; male with aedeagus, in ventral aspect, with notch acute and V-shaped, inner margins of apical incision evenly diverging proximal to notch (Fig. 47D – F); length = 3.20 to 3.66 mm, width = 1.76 to 2.00, length: width = 1.74 to 1.89; California .... *S. rossi* (Leech 1941*a*)

9'. Area between metacoxal lines somewhat inflated, with microsculpture and larger punctures; prosternal process with blade more elongate and narrower with apex not reflexed; female with lobe on last visible sternum short; male with aedeagus, in ventral aspect, with notch broadly U-shaped, inner margins somewhat diverging and broadly separated proximal to notch (Fig. 47A – C); length= 2.84 to 3.24 mm, width = 1.46 to 1.72 mm, length: width = 1.83 to 1.97; Alaska and British Columbia .... 3. *S. pacificus* (Fall)

10(8). Metacoxal plate and abdominal sterna laterally with punctation coarse and dense, without microsculpture between punctures; last visible sternum with a broad, transverse, densely and coarsely punctate impression; aedeagus, in dorsal view, with apical notch shallow and interior angle of apical blade obtuse (Fig. 48A – C); head reddish brown, pronotum dark brown and elytra markedly to somewhat lighter paler basally and reddish brown apically; length = 3.32 to 3.72 mm; width = 1.76 to 2.00 mm; length: width = 1.78 to 1.91; southern California .... *S. latebrosus* (LeConte 1852)

10' Metacoxal plate and abdominal sterna laterally with punctation less coarse and less dense, with microsculpture between punctures; last visible sternum without a broad, transverse impression, punctation uniform except females with medioapical area not punctate 11

11(10). Elytra abruptly paler basally; metacoxal plates and last visible sternum more coarsely and more densely punctate, punctures separated by 1 to 2 times their diameter; head reddish, pronotum with disc reddish to black, and elytra brown with basal maculation; elytron abruptly paler basally; distributed west of Rocky Mountains. 12

11'. Elytra, at most, diffusely paler basally; metacoxal plates and last visible sternum more finely and more sparsely punctate, punctures separated by 3 to 4 times their diameter;; aedeagus, in ventral view, with apical notch in form of an elongate V (Fig. 47V – X); length = 2.60 to 3.28 mm, width = 1.48 to 1.60 mm, length: width = 1.87 to 2.05; head reddish, pronotum with disc piceous to black, and elytra yellowish; British Columbia, Washington, Alberta and Saskatchewan .... 6. *S. edwardsi* (Wallis 1933*a*)

12(11). Elytron bimaculate with basal and apical quarters conspicuously paler; elytron finely, densely punctate; aedeagus as in Fig. 48D – F; length = 3.00 to 3.40 mm, width = 1.52 to 1.72 mm, length: width = 1.91 to 2.02; southern Oregon and northern California ... *S. malkini* (Hatch 1951)

12’. Elytron unciolorus or unimaculate (with only basal quarter conspicuously paler); elytron more coarsely, densely punctate; aedeagus as in Fig. 48G – I; length = 3.28 to 3.64 mm, width = 1.68 to 1.92 mm, length: width = 1.85 to 1.95; California . . . .*S. palliatus* (Horn 1883)

13(7). Metafemur with a tuft of erect, thickened setae basally near insertion of metatrochanter; aedeagus, in lateral aspect, with dorsal flange prominent apically, apical blade with apical notch with inner margins broadly rounded (Fig. 48Q – S); head reddish, pronotum darker, with disc dark reddish brown, elytra reddish brown; length = 2.56 to 3.04 mm, width = 1.36 to 1.68 mm, length: width = 1.81 to 1.89; California (Mendocino Co.) . . . . .10. *S. setifer* new species

13’. Metafemur without a tuft of setae basally 14

14(13). Metacoxa, abdominal sterna and last abdominal sternum with microsculpture absent or effaced; metacoxa with numerous micropunctures among normal punctures; aedeagus with apical notch with inner margins shallowly rounded and converging proximally (Fig. 48W – Y); dorsal color various from uniformly yellowish, to yellowish with pronotum piceous to uniformly piceous; length = 2.80 to 3.40 mm, width = 1.40 to 1.88mm, length: width = 1.78 to 2.00; South Dakota west to California and south to Texas . . . . . *S. vilis* (LeConte 1852)

14’. Metacoxa, abdominal sterna and last abdominal sternum with evident and well impressed microsculpture; metacoxa without visible micropunctures 15

15(14). Body form elongate, relatively parallel sided and, in lateral aspect, strongly depressed; pronotum and elytron finely and sparsely punctate; metacoxa with punctures small and sparse, punctures separated by 4 to 5 times their diameter 16

15’. Body form more ovate and with lateral margins rounded and, in lateral aspect, more convex; pronotum and elytral punctation various; metacoxa with punctures larger and more dense, punctures separated by 1 to 3 times their diameter 17

16(15). Eyes larger, width across eyes: width between eyes = 1.43 to 1.53; head and disc of thorax reddish yellow, elytra yellowish, OR, head, pronotum and elytra uniformly reddish brown; length = 2.72 to 3.00 mm, width = 1.32 to 1.60 mm, length: width = 1.98 to 2.15; aedeagus with inner margins of apical notch more rounded (Fig. 47M – O); Oklahoma and Texas . . . .*S. belfragei* (Sharp 1882)

16’. Eyes smaller, width across eyes: width between eyes = 1.26 to 1.40; head light reddish brown, pronotum with disc dark reddish brown and elytron light reddish brown; aedeagus with inner margins of apical notch more linear (Fig. 48Z – B′); length = 2.62 to 2.72 mm; width =

1.27 to 1.33 mm; length: width = 2.05 to 2.06; Arizona, California (Marin Co., Lassen Co., Los Angeles Co.), Colorado, New Mexico, and Utah .... *S. williami* (Rochette 1986)

17(15). Cave species; aedeagus, in lateral aspect, with dorsal flange very prominent and erect apically, in ventral aspect, with inner margins of notch broadly rounded (Fig. 48M – P); length = 2.7 to 3.0 mm, width = 1.6 to 1.7 mm; México, Tamaulipas .... *S. sbordonii* Franciscolo 1979

17'. Surface water species 18

18(17). Metasternum medially without microsculpture; last visible abdominal sternum coarsely and irregularly punctate; prosternal process with blade short and broad, width subequal to length, depressed medially and with apex reflexed downward, with a low but distinct medial convexity on apical two-thirds; southwestern and Pacific coast species 19

18'. Metasternum medially with microsculpture; last visible abdominal sternum finely punctate OR if coarsely punctate, punctation more uniformly distributed; prosternal process with blade more elongate, width much less than length, with a low but distinct medial convexity on apical half; more northern species 21

19(18). Larger specimens, length 3.0 to 3.9 mm 20

19'. Smaller specimens, length = 2.7 mm; head reddish, pronotum reddish or with disc dark reddish and elytra yellowish red to reddish; aedeagus, in lateral aspect, with dorsal flange high and prominent, in ventral aspect, with notch relatively broad and deep (Fig. 47J – L); width = 1.50 mm, length: width = 1.81; southern California .... *S. barbarensis* (Wallis 1933a)

20(19). California: San Francisco Bay area; pronotum with posterior margin shallowly sinuate and hind angles obtuse; aedeagus, in lateral aspect, with dorsal flange low and inconspicuous apically, in ventral aspect, with notch shallow and with inner margins of notch broadly diverging (Fig. 47 Y, Z, A′); head and elytra reddish brown, pronotum darker, dark reddish brown; length = 3.44 to 3.90 mm, width = 1.92 to 2.12 mm, length: width = 1.80 to 1.90 .... *S. hardyi* (Sharp 1882)

20'. Arizona and Texas south to central Mexico (Mexico); pronotum with posterior margin strongly sinuate and hind angles right-angled; aedeagus, in lateral aspect, with dorsal flange high and conspicuous apically, in ventral aspect, with notch deep and with inner margins almost parallel (Fig. 47B′ – D′); head and elytra reddish brown, pronotum darker, disc dark brown to black; length = 2.96 to 3.60 mm; width = 1.56 to 1.88 mm; length: width = 1.82 to 1.96 .... *S. kingi* (Clark 1862)

21(18). Metacoxa with punctation small and fine; aedeagus (Fig. 47G – I) in lateral aspect with dorsal flange low and inconspicuous apically and in ventral aspect with small, shallow, U-shaped notch; small, oval specimens, length = 2.28 to 2.76 mm, width = 1.20 to 1.1.46 mm, length: width = 1.84 to 1.94; head and pronotum dark brown and elytra yellowish; Alberta . . . . .4. *S. bertae* new species

21'. Metacoxa with punctation more coarse and dense; longer, more ovate specimens 22

22(21). Western species, west of 100th meridian 23

22'. Eastern species, east of 100th meridian 24

23(22). Aedeagus with apical notch U-shaped and with lateral margins of notch rather parallel (Fig. 47S – U); elytra more coarsely and densely punctate posteriorly; many specimens with base of elytra distinctly paler; head dark reddish to brown, pronotum with disc dark brown to piceous, elytra yellow to light brown basally and dark brown apically; size larger, length = 3.08 to 3.48 mm, width = 1.52 to 1.76 mm, length: width = 1.90 to 2.05; British Columbia and Alberta . . . . .5. *S. compertus* (Brown)

23'. Aedeagus with apical notch V-shaped, with lateral margins of notch distinctly converging (Fig.48T – V); elytra more finely and sparsely punctate posteriorly; most specimens with base of elytra only slightly paler; head reddish to piceous; pronotum with disc brown to dark brown, elytra yellowish to light brown and only diffusely paler basally; size smaller, length= 2.88 to 3.24 mm, width = 1.36 to 1.60 mm, length: width = 2.00 to 2.14; transcontinental, British Columbia to Newfoundland, south to Utah and Indiana . . . . .8. *S. pseudovilis* (Young), in part

24(22). Color paler, pronotum with disc brown to dark brown (very few specimens with disc piceous), elytron diffusely paler basally and gradually darkening apically; punctation finer; aedeagus, in dorsal aspect, with apical blade widest distal to mid-length, in ventral view, with apical notch more elongate and acutely V-shaped (Fig. 48T – V); length = 2.73 to 3.10 mm; transcontinental, Newfoundland to British Columbia, south to Utah and Indiana . . . . .8. *S. pseudovilis* (Young), in part

24'. Color darker, pronotum with disc dark brown to black; elytron more distinctly paler basally; punctation coarser; aedeagus, in dorsal aspect, with apical blade widest at or proximal to mid-length, in ventral view, with apical notch shorter and U-shaped; northeastern United States and Canada 25

25(24). Elytron of many specimens more or less bicolored, base distinctly paler than apical portion; pronotum with darker, discal spot smaller and more distinct; elytra with punctation coarser; aedeagus, in ventral aspect, with apical blade widest at mid-length, in lateral view with dorsal flanges relatively higher and more abruptly truncate anteriorly (Fig. 47P – R); Quebec, Labrador . . . . .9. *S. brumalis* (Brown)

25'. Elytron unicolorus, base diffusely paler; pronotum with darker, discal spot larger and more transverse and less distinct; elytra with punctation finer; aedeagus, in ventral aspect, with apical blade widest behind mid-length (Fig. 48J – L); in lateral view with dorsal flanges relatively lower and more rounded anteriorly; Quebec, Labrador and northeastern United States .... 7. *S. planiusculus* (Fall)

1. *Sanfilippodytes corvallis* (Fall 1923)

Fig. 46M, N

Hydroporus corvallis Fall 1923: 49. Type locality Corvallis, Oregon. Holotype female in USNM labelled as follows: Corvallis, 9/22 Or; Coll'n. JD Sherman Jr. 1926; 53 LeConte Coll, Sept. 1912; Hydroporus corvallis Fall, H.C. Fall deter. (yellow label), TYPE (red label)

Selected References. Hatch 1953: 204.

Description. Length = 4.0 to 4.33 mm; width = 1.9 to 2.04 mm; length: width = 2.05 to 2.11. Body elongate and relatively convex, widest at middle, somewhat parallel-sided and attenuate posteriorly.

Color light reddish brown. Head dorsally light reddish brown, darkened posteriorly and laterally; head ventrally yellowish; antennae and palpi yellow. Pronotum light reddish brown with disc obscurely darker; elytra light reddish brown. Ventral surface with pronotum laterally yellowish, remainder of venter darker, somewhat brownish. Legs yellowish red.

Head with very small, moderately dense and evenly spaced punctures. Pronotum with disc with very small punctures (about same size as on head), punctures much larger and more dense toward margins, coarse and dense on posterolateral angle. Elytron with punctures larger and more dense, punctation dual with micropunctures scattered among larger punctures; lateral and discal serial rows of punctures toward base with punctures more dense and almost confluent; epipleuron with a few scattered, coarse punctures. Metasternum laterally with coarse, dense punctures, metacoxal plate with punctures small and less dense, punctures separated by 2 to 3 times their diameter. Abdominal sterna laterally with small, sparse punctures. Microreticulation evident over entire dorsal and ventral surface.

Pronotal bead broad, subequal in width to a median antennomere. Pronotum with posterolateral angle obtuse; basal margin straight on each side of basomedial lobe. Elytron with lateral margin gently curving upward in lateral aspect, epipleuron visible almost to shoulder. Prosternum medially with a distinct convexity extending from base of process to anterior margin; process with declivity distinct, file absent and prominence distinct; blade broadest anteriorly, much longer than wide, medial convexity complete but low and rounded, apex broadly rounded. Metacoxal lines slightly but distinctly reflexed toward midline anterior to metacoxal processes, metacoxal lines distinctly diverging proximally. Metatrochanter relatively small, length of metafemur: length of metatrochanter = 2.30 to 2.32.

Sternum 6 not dimorphic apically, with apex evenly rounded. Males and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 46M, N) , in dorsal aspect, not expanded subapically and without apical blade and dorsal flanges, apical notch consisting of a medial incision which distinctly separates the apical lobes.

Comments. We transfer *Hydroporus corvallis* (Fall) to the genus *Sanfilippodytes* Franciscolo. Fall (1923) mistook the female holotype that he examined as a member of the *oblitus*-group (= H*ydrocolus*, n. gen.) rather than being a member of the *H. vilis*-group (= *Sanfilippodytes*). We have examined two specimens [holotype (see above) and a male, in CNC (Corvallis, Ore., iv.26.1924, G. Hopping)] which match all of Fall's characteristics for the species but the protibia of the male is not notched and the apex of the aedeagus is divided.

Ecology. Nothing is known about the ecology of this species and only two specimens have been seen. The holotype was collected in September and the other specimen was collected in late spring (26 April). Some species in the genus appear to be winter active (see comments under *S. setifer* below) and such habits could attribute to them being rarely collected.

Distribution. This species is known only from two specimens from Corvallis, Oregon. It is probably much more widespread but due to its unknown habits, it is poorly collected.

2. *Sanfilippodytes terminalis* (Sharp 1882)

Fig. 46D – F

Hydroporus terminalis Sharp 1882: 484. Type locality - "California". Type material not examined.

Hydroporus browni Wallis 1933a: 261. Type locality - Grand Coulee, Grant County, Washington. Holotype male in CNC labelled as follows: Grand Coulee, Wn, Grant County; 0. Edwards, IV/1/33; Holotype [in red ink], Hydroporus browni Wallis; HoloTYPE Hydroporus browni Wallis No. 6991; Hydroporus browni Wallis = H. terminalis Sharp det. R.A. Rochette 25/i/1983. NEW SYNONYMY.

Selected References. Fall 1923: 60; Hatch 1953: 205; Leech and Chandler 1956: 317.

Description. Length = 2.50 to 2.90 mm; width = 1.28 to 1.42 mm; length: width = 1.91 to 2.05. Body elongate oval and relatively convex, widest at middle and relatively evenly rounded laterally.

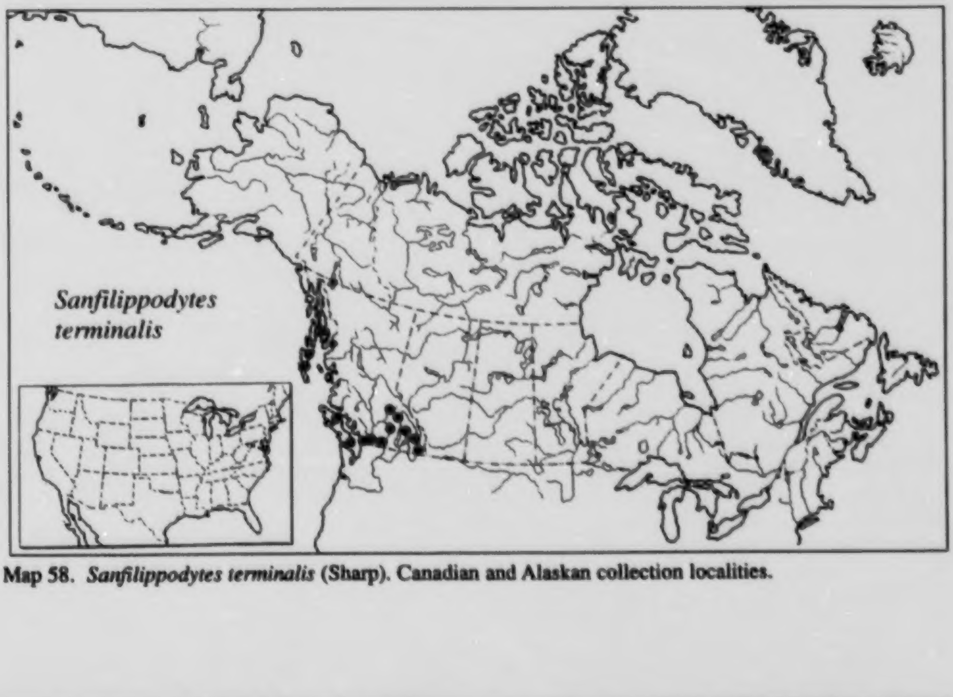
Color light yellowish brown to dark reddish brown, most specimens with head and pronotum darker and contrasting with lighter elytra. Head dorsally dark reddish to brown except anterior margin paler, yellow to reddish; head ventrally with gula yellow, genae yellow to reddish brown. Antenna reddish, most specimens with antennomeres 5 to 11 piceous apically; palpi yellow with apical palpomeres infuscate. Pronotum with disc light brown to dark brown with very broadly lighter, reddish margins; elytron uniformly yellowish to reddish; epipleuron reddish. Ventral surface largely black to piceous. Legs reddish.

Head with small and moderately dense and evenly spaced punctures. Pronotum with disc with very small punctures (about same size as on head), punctures much larger and more dense towards margins, coarse and dense on posterolateral angle. Elytron with punctures larger and somewhat more dense, punctation dual with a few micropunctures scattered among larger punctures (more apparent basally); epipleuron with numerous shallow punctures. Metasternum laterally with large, shallow almost confluent punctures, metacoxal plate with punctures moderately small and moderately dense, punctures separated by about 2 times their diameter, smaller in size than those of abdominal sterna 1 and 2 laterally. Abdominal sterna laterally with coarse, dense punctures; sternum 6 with punctures small and moderately dense. Microreticulation evident over entire dorsal and ventral surface.

Pronotal bead broad, as wide as antennomere 5 or 6. Pronotum with posterolateral angle obtuse; basal margin shallowly but distinctly sinuate on each side of basomedial lobe. Elytron with lateral margin slightly sinuate in lateral aspect, epipleuron disappearing posterior to shoulder. Prosternum medially with a distinct convexity extending from base of process to anterior margin; process with declivity poorly developed, file obsolete, prominence represented by a small medial tooth; blade narrow and elongate, much longer than wide, most specimens with medial convexity complete and best developed apically and less distinct basally, apex bluntly pointed. Metacoxal lines slightly but distinctly reflexed toward midline anterior to metacoxal processes, metacoxal lines distinctly diverging proximally. Metatrochanter relatively small, length of metafemur: length of metatrochanter greater than 2.2.

Sternum 6 not dimorphic apically, with apex evenly rounded. Males and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 46D – F), in lateral aspect, not expanded subapically and without dorsal flanges, apical blade and apical notch; apex entire, truncate to broadly rounded and somewhat curled ventrally.

Comments. Rochette (pers. comm.) suggested that *S. browni* and *S. terminalis* are conspecific. These two names appear to characterize two ends of a north south cline in variation. There are subtle differences in microsculpture and size which are correlated with differences in the apex of the aedeagus of the male and distribution. Rochette interpreted specimens from the middle of the geographic range (Oregon and Washington) to be intermediate in structure. We accept his synonymy.



Map 58. *Sanfilippodytes terminalis* (Sharp). Canadian and Alaskan collection localities.

Ecology. The habitat of this species has not been described although it almost certainly occurs in cold springs and seeps.

Distribution. Map 58. The distribution of this species is west of the Rocky Mountains from British Columbia south through Washington, Idaho and Oregon to California.

3. *Sanfilippodytes pacificus* (Fall 1923)

Fig. 47A – C

Hydroporus pacificus Fall 1923: 58. Type locality - Massett, Queen Charlotte Islands, British Columbia. Type not examined.

Selected references. Leech 1941*a*: 130, Hatch 1953: 205.

Description. Length = 2.92 to 3.24 mm; width = 1.46 to 1.68 mm; length: width = 1.83 to 1.97. Body oval and somewhat depressed, widest just anterior to middle and relatively evenly rounded laterally.

Color yellowish brown, with lighter elytra strongly contrasting with black pronotum and brownish head. Head dorsally yellowish red except anterior margin paler, yellow to reddish, and posterolaterally slightly darker, dark red to brown, and small lateral area posterior to eye, piceous to black; head ventrally with gula yellowish and genae darker, reddish brown. Antenna yellowish red, some specimens with antennomeres 5 to 11 piceous apically; palpi yellow with apical palpomeres lightly infuscate. Pronotum with disc dark brown to black with very broadly lighter, reddish margins; elytron uniformly yellowish to reddish; epipleuron reddish. Ventral surface largely black to piceous, except pronotum laterally, reddish. Legs reddish.

Head with very small, moderately dense and evenly spaced punctures. Pronotum with disc with small punctures medially, punctures somewhat larger and more dense toward margins, dense but not much coarser on posterolateral angle. Elytron with punctures small, shallow and dense, punctation dual with micropunctures obscured by microsculpture; epipleuron with a few fine, shallow punctures. Metasternum laterally with small but quite dense punctures, metacoxal plate with punctures small and sparse, punctures separated by 3 to 4 times their diameter. Abdominal sterna laterally with fine, relatively sparse punctures; sternum 6 with punctures fine and relatively sparse, absent from area at base of apical lobe. Microreticulation evident over entire dorsal and ventral surface.

Pronotal bead narrower, not as wide as a median antennomere. Pronotum with posterolateral angle obtuse; basal margin sinuate on each side of basomedial lobe. Elytron with lateral margin gently curving upward in lateral aspect, epipleuron visible almost to shoulder. Prosternum medially without a medial convexity anterior to base of process; process with declivity poorly developed, file obsolete, prominence represented by a small medial tooth; blade narrow and elongate, much longer than wide, with medial convexity distinct only near apex; apex bluntly pointed and reflexed downward. Metacoxal lines widely separated anterior to metacoxal processes, metacoxal lines almost parallel and diverging only slightly proximally. Metatrochanter relatively large, length of metafemur: length of metatrochanter less than 1.90.

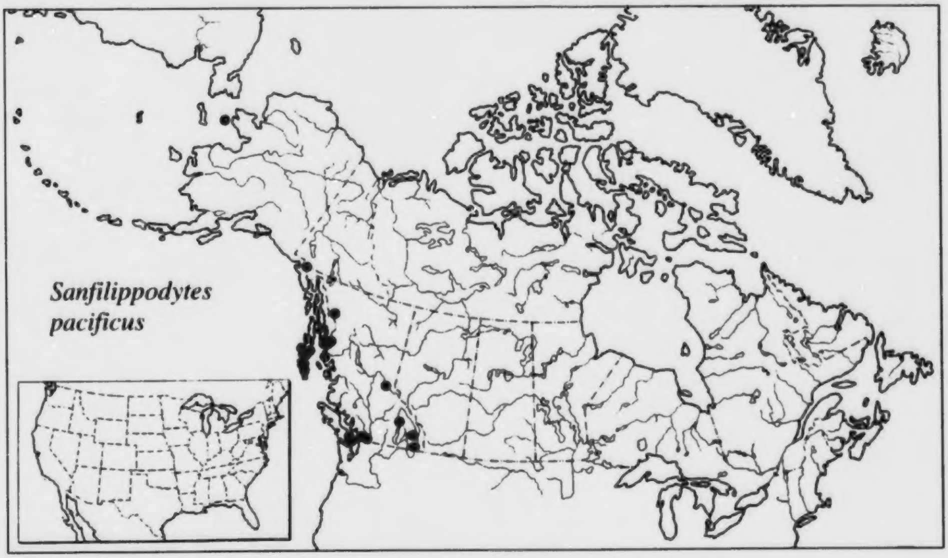
Sternum 6 with apex sexually dimorphic; male with apex rounded, female with apex slightly produced posteriorly at middle as a small apical lobe which in lateral aspect is reflexed downward. Otherwise male and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 47A – C), in ventral aspect, gradually widened distally to form apical blade, with an extremely broad and deep U-shaped apical notch creating narrow, elongate apical lobes; in lateral aspect, the form is very thick and without differentiation of the apical blade; in dorsal aspect, without dorsal flanges and with apical lobes broadly separated.

Comments. Leech (1941*a)* made reference to *S. pacificus* in his description of *S. rossi* Leech. There is a complex of species centred around *S. rossi* and *S. pacificus* which is characterized by the female with the last visible abdominal sternum slightly produced and reflexed downward at apex and the male with the aedeagus with the angle of formation of the apical blade very gradual.

Another set of species (*S. latebrosus*, *S. palliatus*, *S. malkini* and *S. edwardsi*) have the female with the last visible abdominal sternum impressed anterior to the apex and with the tip reflexed downward and the last sternum appears similar in lateral profile to that of *S. rossi* and *S. pacificus*. This character state might not be homologous however as in the former set of species the apex is rounded and it is not produced apically.

Ecology. The habitat of this species has not been described although it almost certainly occurs in cold springs and seeps.

Distribution. Map 59. This species is only known from Alaska and British Columbia but it probably occurs further south into, at least, Washington.



Map 59. *Sanfilippodytes pacificus* (Fall). Canadian and Alaskan collection localities.

4. *Sanfilippodytes bertae* Roughley and Larson, new species

Fig. 47G – I

HOLOTYPE. Male, in CNC, labelled as follows – Ft. Macleod, Alta. 31.III.1984, Lot 1 BF & JL Carr.

ALLOTYPE. Female - same locality and collector.

PARATYPES. 28 specimens from same locality and collector (16.iii.1980, 31.iii.1984, 5.v.1984) and 12 specimens labelled Alta, Old Man R., Ft. Macleod, May 5, 1984, Carr & Larson, to be deposited in various museums.

Etymology. This species is named in honour of Mrs. Bertha (Bert) F. Carr of Calgary who helped collect the type series. Bert, along with her husband, John, has been a tremendous source of specimens, information and inspiration for this project.

Description. Length = 2.3 to 2.8 mm; width = 1.2 to 1.5 mm; length: width = 1.84 to 1.94. Body form oval, depressed, widest anterior to middle and relatively evenly rounded laterally.

Color yellowish brown, with lighter elytra contrasting with brownish red head and pronotum. Head dorsally reddish yellow except anterior margin paler, yellow; head ventrally with gula yellowish and genae darker, yellowish red to brown. Antenna yellow to yellowish red; palpi yellow. Pronotum with medial area on disc dark brown to piceous with very broadly lighter, reddish to yellowish margins; elytron yellow to yellowish red, some specimens gradually darkening medially to very light brown; epipleuron yellow to yellowish red. Ventral surface largely brown, except pronotum laterally, metasternum medially, posterior margin of metacoxal plates and abdominal sterna laterally, yellowish. Legs yellowish.

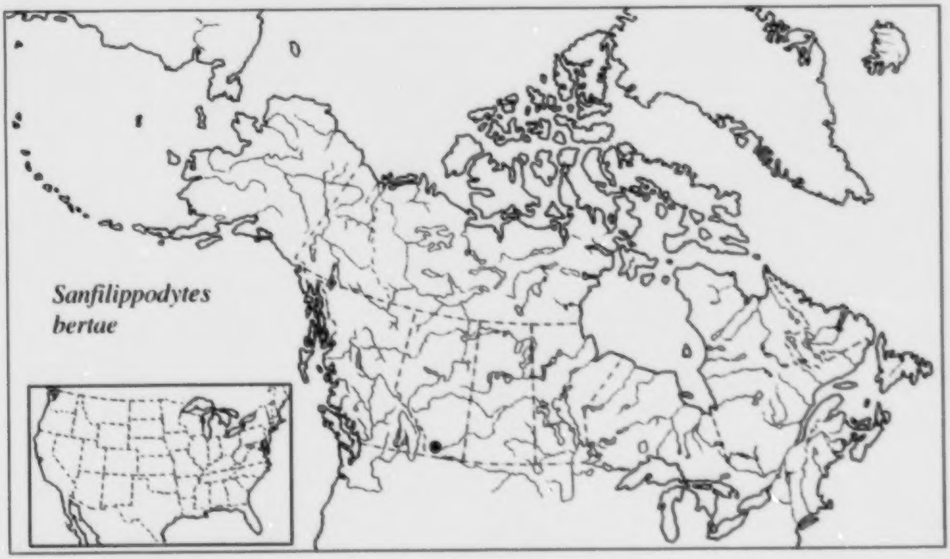
Head with very small, moderately sparse and evenly spaced punctures. Pronotum with disc with small punctures medially (much larger than those on head), punctures somewhat larger and more dense toward margins, posterior margin with many punctures in subconfluent rows, punctures dense on posterolateral angle. Elytron with punctures small, fine and not particularly dense, punctation dual with micropunctures obscured by microsculpture; epipleuron impunctate or with a few, scattered shallow punctures. Metasternum laterally with small, dense, subconfluent punctures, metacoxal plate with punctures very small and sparse on disc, punctures separated by 4 to 5 times their diameter, anterolaterally with punctures obscured by shallow, oblique impressions. Abdominal sterna laterally with fine, quite sparse punctures; sternum 6 with punctures very small and fine and quite sparse. Microreticulation evident over entire dorsal and ventral surface.

Pronotal bead narrower, not as wide as a median antennomere. Pronotum with posterolateral angle obtuse; basal margin sinuate on each side of basomedial lobe. Elytron with lateral margin gently curving upward in lateral aspect, epipleuron visible almost to shoulder. Prosternum without a medial convexity anterior to base of process; process with declivity poorly developed, file obsolete, prominence low and inconspicuous, blade relatively narrow and elongate, much longer than wide, with lateral margins broadly inflated and broadly excavated medially, medial convexity absent or low and rounded and visible only in apical half; apex broadly rounded. Metacoxal lines widely separated anterior to metacoxal processes, metacoxal lines almost parallel and diverging only slightly proximally. Metatrochanter relatively large, length of metafemur: length of metatrochanter less than 1.80.

Sternum 6 not dimorphic apically, with apex evenly rounded. Males and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 47G – I), in ventral aspect, abruptly widened distally to form apical blade, with a small, shallow, U-shaped notch, in lateral aspect, the form is thick with the apical blade poorly differentiated, in dorsal aspect with low but distinct dorsal flanges and wide, broad apical lobes.

Ecology. The only known locality for this species is along the north bank of the Old Man River just upstream of the Highway 2 crossing near Fort MacLeod, Alberta. The beetles occurred in small seepages and springs which flowed out of the river banks at about the level of the high water marks. The substrates were mainly hard clay, gravel and sandstone rubble. These seeps are probably flooded during spring runoff so it seems unlikely the beetles are restricted to this site. Possibly they occur in springs farther back from the river and colonize the river bank seeps during non-flood periods.

Distribution. Map 60. Presently this species is only known from a single locality in southern Alberta. However, it is probably more widespread throughout the northwestern Great Plains and Rocky Mountain foothills.



Map 60. *Sanfilippodytes bertae* Roughley and Larson. Canadian and Alaskan collection localities and United States state records.

5. *Sanfilippodytes compertus* (Brown 1932)

Fig. 47S – U

Hydroporus compertus Brown 1932*a*: 4. Type locality - Copper Mountain, British Columbia. Holotype male in CNC labelled as follows: Copper Mtn., B.C. 15.vi.1930, G. Stace Smith; HOLOTYPE Hydroporus compertus Brown No. 3241.

Hydroporus falsificus Brown 1933: 44. Type locality - Wynndel, British Columbia. Holotype male in CNC labelled as follows: Wynndel, B.C., 23.viii.1931, G. Stace Smith, HOLOTYPE, Hydroporus falsificus Brown No. 3400 (red label). NEW SYNONYMY.

Selected References. Hatch 1953: 204; Larson 1975: 292.

Description. Length = 3.1 to 3.5 mm; width = 1.5 to 1.8 mm; length: width = 1.90 to 2.05. Body form elongate oval, somewhat depressed, widest at middle and relatively evenly rounded laterally.

Color dark brown with prominent pale area across elytra at base. Head dorsally dark reddish to brown except anterior margin paler and medial area on frons, yellowish to light reddish; head ventrally with gula yellow, genae yellow to reddish. Antenna reddish, some specimens with antennomeres 5 to 11 piceous apically; palpi yellow. Pronotum with disc dark brown to piceous with very broadly reddish margins; elytron laterally and basally yellowish, most specimens abruptly darkening medially and in posterior three-quarters; epipleuron reddish basally and darker apically. Ventral surface largely black to piceous. Legs reddish to pale brown.

Head with very small, moderately sparse and evenly spaced punctures. Pronotum with disc with small punctures medially (much larger than those on head), punctures somewhat larger and more dense toward margins, punctures dense on posterolateral angle. Elytron with punctures relatively dense and coarse, punctation dual with micropunctures scattered among larger punctures and obscured by microsculpture; epipleuron coarsely and densely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally and gradually becoming smaller posteriorly to sternum 3; metacoxal plate with punctures large and dense, punctures separated by about 1 to 2 times their diameter, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small but well impressed and dense.

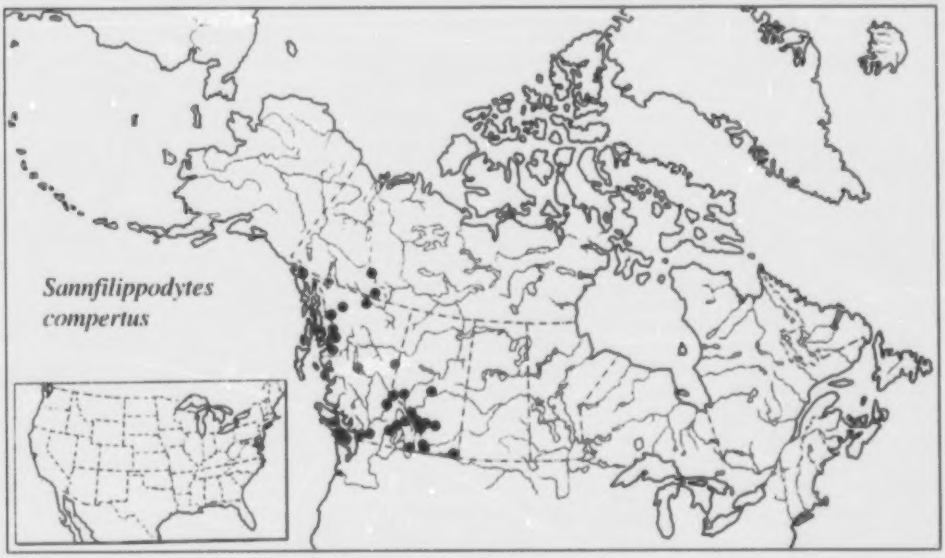
Pronotal bead narrower, not as wide as a median antennomere. Pronotum with posterolateral angle obtuse; basal margin shallowly sinuate on each side of basomedial lobe. Elytron with lateral margin gently curving upward in lateral aspect, epipleuron visible almost to shoulder. Prosternum without a medial convexity anterior to base of process; process with declivity poorly developed, file obsolete, prominence low and inconspicuous, blade widest anteriorly, much longer than wide, and relatively flat to slightly concave medially, or some specimens with low rounded medial convexity best developed toward apex; apex bluntly pointed. Metacoxal lines widely separated anterior to metacoxal processes, metacoxal lines almost parallel and diverging only slightly proximally. Metatrochanter relatively large, length of metafemur: length of metatrochanter less than 2.1.

Sternum 6 not dimorphic apically, with apex evenly rounded. Males and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 47S – U), in ventral aspect, abruptly widened distally to form apical blade, with a deep, U-shaped apical notch, in lateral aspect, with the apical blade well differentiated, in dorsal aspect, with high, erect dorsal flanges and wide, broad apical lobes.

Comments. Fall (1934) placed *S. brumalis* (Brown), *S. compertus* (Brown) and *S. falsificus* (Brown) as junior, subjective synonyms of *S. planiusculus* (Fall). Most subsequent authors have not followed Fall's synonymy and we recognize *S. brumalis* as a valid species (see below).

Ecology. Larson (1975) reported specimens taken from cold springs, rivers and alpine and subalpine lakes where they occur under cover near the waterline.

Distribution. Map 61. This species is known presently from British Columbia and Alberta. Undoubtedly it is more widespread on the northern Great Plains and the Pacific Northwest of the United States.



Map 61. *Sanfilippodytes compertus* (Brown). Canadian and Alaskan collection localities.

6. *Sanfilippodytes edwardsi* (Wallis 1933)
Fig. 47V – X

Hydroporus edwardsi Wallis 1933*a*: 261. Type locality - Grand Coulee, Grant Co., Washington. Holotype female in CNC labelled as follows: Grand Coulee, IV/2/33, O. Edwards; Holotype Hydroporus edwardsi Wallis; HoloTYPE Hydroporus edwardsi Wallis No. 6990.

Selected References. Hatch 1953: 204; Larson 1975: 291.

Description. Length = 2.6 to 3.1 mm; width = 1.4 to 1.6 mm; length: width = 1.87 to 1.97. Body form oval, attenuate posteriorly, depressed, widest just anterior to middle and relatively evenly rounded laterally.

Color yellowish brown, with lighter elytra contrasting with darker pronotum and brownish head. Head dorsally dark reddish brown to piceous except anterior margin paler, yellow to reddish; head ventrally entirely pale or many specimens with gula yellowish and genae darker, reddish brown. Antenna yellowish red, some specimens with antennomeres 5 to 11 piceous apically; palpi yellow. Pronotum with disc dark brown to black with very broadly lighter, reddish margins; elytron laterally and basally yellowish to reddish brown, gradually darkening medially and posteriorly to dark brown; epipleuron reddish basally, darkened posteriorly. Ventral surface largely piceous to black, except pronotum laterally, reddish. Legs reddish.

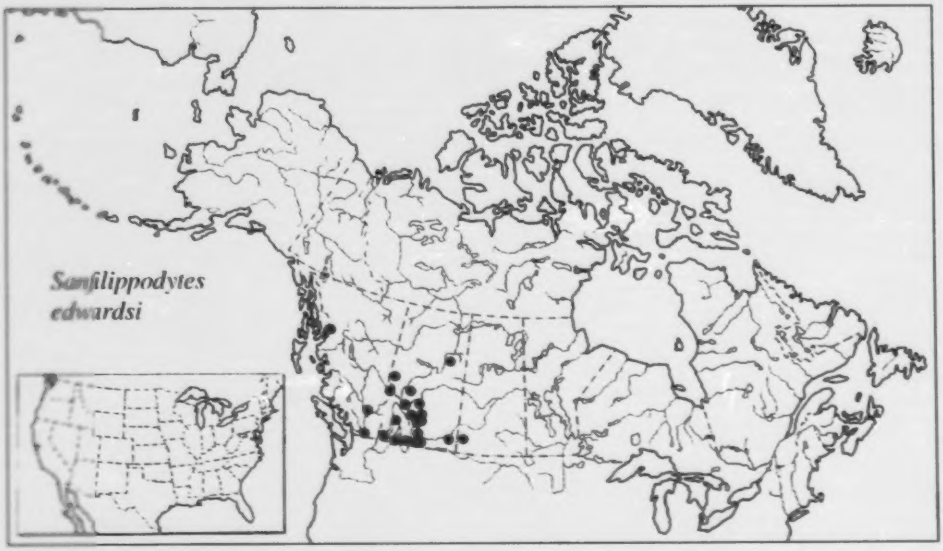
Head with very small, moderately dense and evenly spaced punctures. Pronotum with disc with small punctures medially, punctures somewhat larger and more dense toward margins, coarse and dense on posterolateral angle. Elytron with punctures small, but deeply impressed and dense, punctation dual with micropunctures obscured by microsculpture; epipleuron moderately densely punctate. Metasternum laterally with small to coarse, dense, subconfluent punctures, metacoxal plate with punctures small and sparse, punctures separated by 2 to 3 times their diameter. Abdominal sterna laterally with fine, relatively sparse punctures; sternum 6 with punctures fine and relatively sparse, absent from area at base of apical lobe. Microreticulation evident over entire dorsal and ventral surface.

Pronotal bead narrower, not as wide as a median antennomere. Pronotum with posterolateral angle obtuse; basal margin sinuate on each side of basomedial lobe. Elytron with lateral margin gently curving upward in lateral aspect, epipleuron visible almost to shoulder. Prosternum without a medial convexity anterior to base of process; process with declivity poorly developed, file obsolete, prominence low and inconspicuous, blade widest anteriorly, much longer than wide, with medial carina distinct on most specimens and on some specimens obvious only apically; apex bluntly pointed. Metacoxal lines widely separated anterior to metacoxal processes, metacoxal lines almost parallel and diverging only slightly proximally. Metatrochanter relatively large, length of metafemur: length of metatrochanter less than 1.90.

Sternum 6 with apex sexually dimorphic; male with apex rounded, female with apex slightly produced posteriorly at middle as a small apical lobe which in lateral aspect is reflexed downward. Otherwise male and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 47V – X), in ventral aspect, abruptly widened distally to form apical blade, with a narrow, deep V-shaped apical notch, in lateral aspect, the form is thick but with a clear differentiation of the apical blade, in dorsal aspect, with distinct dorsal flanges and with wide apical lobes narrowly separated.

Ecology. Larson (1975) reported specimens taken from under rocks along margins of small cold springs and creeks over sand and clay substrate. He also reported teneral specimens from August in Alberta.

Distribution. Map 62. This species, at present, is known from British Columbia, Washington, Alberta, and Cypress Hills, Saskatchewan.



Map 62. *Sanfilippodytes edwardsi* (Wallis). Canadian and Alaskan collection localities.

7. *Sanfilippodytes planiusculus* (Fall, 1923)
Fig. 48J – L

Hydroporus planiusculus Fall 1923: 58. Type locality — Mt. Adams, 3,500 ' elev., White Mountains, New Hampshire.

Selected Reference. Young 1953*d*: 116–121.

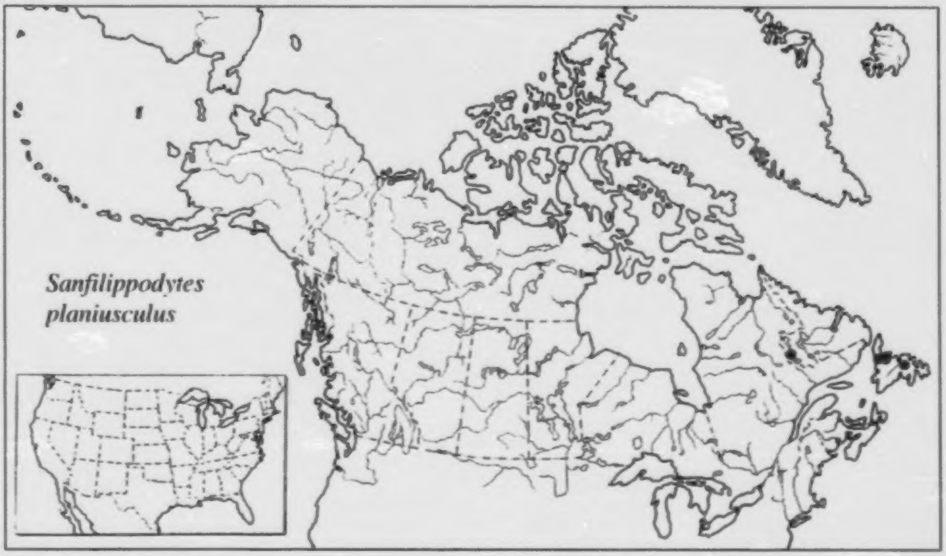
Description. The majority of features are as in *S. compertus*, except as follows. Length = 3.2 to 3.4 mm; width = 1.6 to 1.7 mm; length: width = 1.98 to 2.05.

Color light brown to reddish brown with elytra at base only vaguely paler and with dark spot on pronotum relatively larger and transversely elongate and suffused laterally into surrounding yellowish red area, prominent pale area across elytra at base less distinct and only vaguely paler; head with medial area of frons not lighter in color; pronotum with medial genae yellow to piceous and contrasting with gula or not; many specimens with pronotum posterolaterally with many coarser punctures subconfluent and forming sinuate impressions; antennomeres 5 to 7 wider, elytra with punctation coarser, more dense, and slightly more impressed than on either *S. compertus* or *S. brumalis* (about equal to that of *S. pseudovilis*); metacoxal plates and sternum 6 with punctures as in *S. compertus*.

Aedeagus (Fig. 48J – L) quite broad and thick and in lateral aspect with dorsal flanges high and prominent and abruptly rounded distally, apex with distal portion thinner but short and somewhat curving up apically, in dorsal aspect with apex emarginate medially, angles of emargination broad but shallow and ending proximally in a squared U, angle of formation of apical blade distinctly if subtly angulate near base of blade and blade widest near base.

Ecology. In Newfoundland and Labrador specimens have been found in small, cold springs where the beetles occur under cover on clay to gravelly soils. At Hermit Lake, Mt. Washington, New Hampshire, this species occurs at about 1300 – 1400 metre elevation.

Distribution. Map 63. Many of the older records for *S. planiusculus* actually refer to *S. pseudovilis*. This species as presently defined, is a northern Appalachian species with Canadian records from eastern Quebec, Labrador and Newfoundland.



Map 63. *Sanfilippodytes planiusculus* (Fall). Canadian and Alaskan collection localities.

8. *Sanfilippodytes pseudovilis* (Young 1953)
Fig. 48T – V

Hydroporus pseudovilis Young 1953*d*: 116 – 119. Type locality — E.S. George Reserve near Pinckney, Livingston County, Michigan.

Selected References. Young 1953*d*: 116 – 121, Larson 1975: 293 – 294 (as *H. planiusculus* Fall), Hilsenhoff 1995: 21.

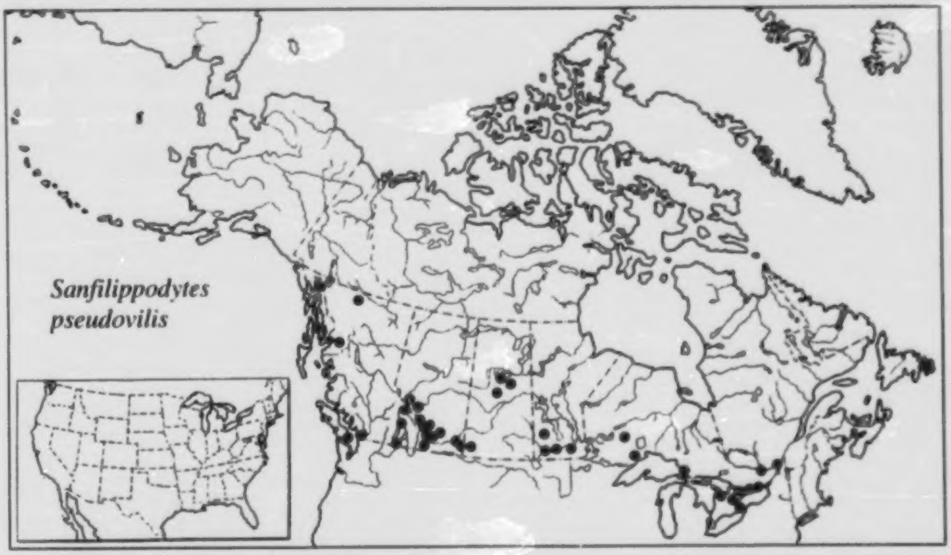
Description. The majority of features are as in *S. compertus*, except as follows. Average size smaller than in *S. compertus* and *S. brumalis* but with some degree of geographic variation with western Canadian specimens being a bit larger (length = 2.9 to 3.2 mm; width = 1.4 to 1.6 mm; length: width = 2.00 to 2.14) and eastern specimens a bit smaller (length = 2.7 to 3.2 mm); shape a bit narrower and more elongate and the elytra not bicolorous. Color light brown to reddish brown, pronotum with disc black, with elytra at base only vaguely paler; head with medial area of frons not lighter in color; genae yellow to piceous and contrasting with gula or not; many specimens with pronotum posterolaterally with many coarser punctures subconfluent and forming sinuate impressions; elytra with punctation slightly coarser, slightly more dense, and slightly more impressed than on either *S. compertus* or *S. brumalis*; metacoxal plates and sternum 6 with punctures slightly finer and slightly more sparse than on either *S. compertus* or *S. brumalis*.

The main distinguishing features for this species are in the form of the aedeagus. Aedeagus (Fig. 48T – V) quite broad and thick and, in lateral aspect, with dorsal flanges high and prominent and abruptly truncately notched distally, apex with distal portion thicker and more or less truncate, in dorsal aspect, with apex emarginate medially, angles of emargination broad and deep and ending proximally in a distinct V, angle of formation of apical blade smoothly rounded and blade widest subapically.

Comments. This species has long been confused with *S. planiusculus* (Fall). Because an adequate species definition was lacking, the distribution of the latter was accepted as widespread in North America. Critical study of available material suggests that *S. planiusculus* is restricted to the northeastern United States and adjacent Canada whereas *S. pseudovilis* is much more widespread.

Ecology. The species is very common in cold stenothermal springs where it can be taken either in the limnocrene pools or among the mosses along the spring margin. Larvae have been taken fairly deeply within the seeping mossy banks well back from the edges of a spring-brook near Aweme, Manitoba. The mature larva was described by Alarie (1991) as *Hydroporus planiusculus*. Larson (1975, as *H. planiusculus*) recorded this species from under rocks on the shoreline of cool to cold springs, creeks, lakes and spring- or seepage-fed, cold borrow pits over mineral substrates. He recorded teneral specimens as being collected between July 17 and August 23.

Distribution. Map 64. Many of the older records for *S. planiusculus* actually refer to *S. pseudovilis*. It is a transcontinental species in Canada with records from British Columbia to Newfoundland and scattered records from east of the Appalachians in the United States, south to Utah and Indiana.



Map 64. *Sanfilippodytes pseudovilis* (Young). Canadian and Alaskan collection localities.

9. *Sanfilippodytes brumalis* (Brown 1930)

Fig. 47P – R

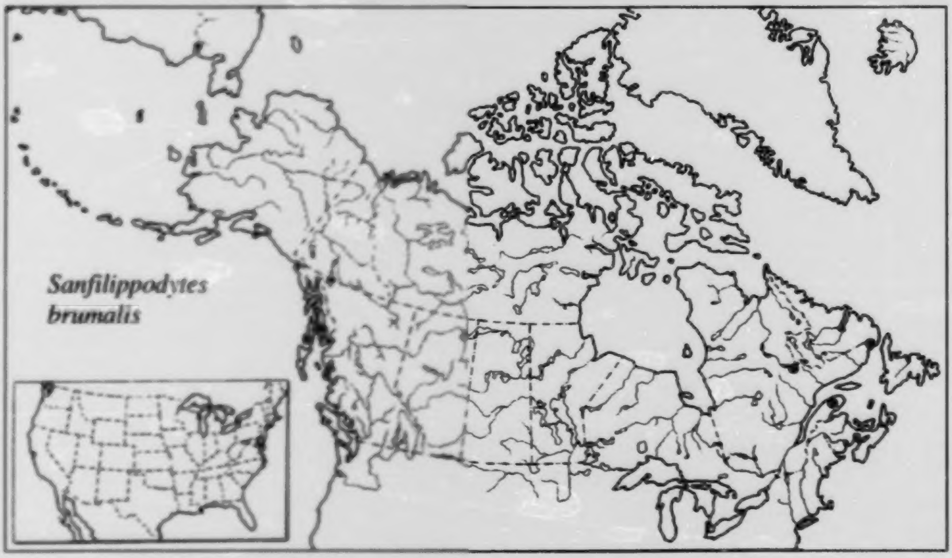
Hydroprous brumalis Brown 1930*b*: 235. Type locality – Bonne Esperance, Quebec. Holotype female in CNC labelled as follows: Bonne Esperance, Que., 14.vii.1929, W.J. Brown; HOLOTYPE Hydroporus brumalis Brown No. 3165.

Selected Reference. Young 1953*d*: 116–121.

Description. The majority of features are as in *S. compertus*, except as follows: Length = 3.0 to 3.4 mm; width = 1.5 to 1.7 mm; length: width = 1.93 to 2.05. Color light brown to reddish brown with dark spot on pronotum relatively small and isolated by surrounding yellowish red area, prominent pale area across elytra at base less distinct and only vaguely paler, on some specimens; genae yellow and not contrasting with gula; elytra with punctation slightly finer, slightly more sparse, and slightly less impressed; metacoxal plates and sternum 6 with punctures a bit larger and slightly more dense.

The main distinguishing features for this species are in the form of the aedeagus, (Fig. 47P – R) notch on ventral surface shallow and more or less U-shaped, lateral portions of the apical blade angulate (not rounded) and widest at mid-length in lateral view and with dorsal flanges relatively higher and more abruptly truncate anteriorly.

Comments. Fall (1934) placed *S. brumalis* (Brown), *S. compertus* (Brown) and *S. falsificus* (Brown) as junior, subjective synonyms of *S. planiusculus* (Fall). Based on differences in the form of the shape of the aedeagus, however, Young (1953*d*) distinguished among *S. brumalis*, *S. planiusculus* and *S. pseudovilis* (Young). Detailed study of the form of the aedeagus suggests that these latter taxa are each valid and distinct. However, as the variation in this species becomes better understood, it may well end up as a junior synonym of *S. planiusculus*.



Map 65. *Sanfilippodytes brumalis* (Brown). Canadian and Alaskan collection localities.

Ecology. In Newfoundland, specimens have been collected from the head of a small, cold, valley-bottom spring that was shaded by alders. Rocks were present but there was also abundant organic silt. Specimens were also collected from springs above tree-line in the Long Range Mountains where they were in small seepage areas and springs, and were under rocks lying on sandy-clay soil. On Mt. Albert, Quebec this species occurs between 650 and 3,200 ft. elevation.

Distribution. Map 65. Presently known only from a few localities in Quebec and Labrador.

10. *Sanfilippodytes setifer* Roughley and Larson, new species

Fig. 48Q – S

HOLOTYPE - male, in CASC, labelled as follows: Caspar, Calif., Mendocino Co., 5.II.48, Hugh B. Leech/ pond in woods, H. B. Leech Collection.

PARATYPES - in CASC, same as holotype, except, Dec. 1941, J.R. Helfer, pond in woods (1, CASC), Caspar, Mend. Co., Cal., 19, XII-16-1934, J.R. Helfer Coll., in small pool(1, CASC); CAL., Mendocino Co., 3 mi N. Mendocino, behind Helfer Ranch, 9.IV.1966, winter rain pools in woods, H.B. Leech leg. (7)

Etymology. This derivation of the specific epithet of this species, setifer, is based on the distinctive patch of setae at the base of the femur.

Description. Length = 2.5 to 3.1 mm; width = 1.4 to 1.7 mm; length: width = 1.81 to 1.89. Body form oval, convex, widest at middle and relatively evenly rounded laterally.

Color dark brown, with head dark reddish brown, pronotum medially piceous to black and elytra dark reddish brown. Head dorsally dark reddish brown except anterior margin paler, reddish; head ventrally with gula yellowish and genae darker, dark red to light brown. Antenna yellowish red; palpi yellow. Pronotum with medial area on disc dark brown to piceous with very broadly lighter margins, reddish to yellowish; elytron dark brown to reddish brown; epipleuron dark reddish and darker posteriorly. Ventral surface largely piceous to black, except pronotum laterally, yellowish. Legs yellowish.

Head with very small, moderately sparse and evenly spaced punctures. Pronotum with disc with small punctures medially (much larger than those on head), punctures somewhat larger and more dense toward margins, punctures dense on posterolateral angle. Elytron with punctures moderately large, coarse and dense, punctation dual with many micropunctures scattered among larger punctures; epipleuron with a few, scattered shallow punctures. Metasternum laterally with coarse and sparse but subconfluent punctures, metacoxal plate with punctures small and sparse on disc, punctures separated by 3 to 4 times their diameter. Abdominal sterna laterally with small, sparse punctures; sternum 6 with punctures small and sparse. Microreticulation evident over entire dorsal and ventral surface.

Pronotal bead narrower, not as wide as a median antennomere. Pronotum with posterolateral angle obtuse; basal margin shallowly sinuate on each side of basomedial lobe. Elytron with lateral margin almost straight and only perceptibly curving upward in lateral aspect, epipleuron visible almost to shoulder. Prosternum with a medial convexity anterior to base of process; process with declivity poorly developed, file obsolete, prominence low and inconspicuous, blade relatively widest anteriorly, much longer than wide, with low median convexity in apical half; apex bluntly pointed. Metacoxal lines widely separated anterior to metacoxal processes, metacoxal lines almost parallel and diverging only slightly proximally. Metatrochanter relatively large, length of metafemur: length of metatrochanter less than 2.1. Metafemur in basal quarter, distal to apex of metatrochanter, with long golden setae, setae about one-quarter width of femur.

Sternum 6 not dimorphic apically, with apex evenly rounded. Males and females very similar; males with protarsomeres 1 to 3 slightly expanded and with larger scales on ventral surface. Aedeagus (Fig. 48Q – S), in ventral aspect, abruptly widened distally to form apical blade, with a small, shallow, U-shaped notch, in lateral aspect, the form is thick with the apical blade well differentiated, in dorsal aspect, with high, erect dorsal flanges and wide, broad apical lobes.

Comments. During the course of examination of a wide selection of specimens assigned to this genus, a distinctive new species was recognized from California. Interestingly it is from a well-known locality – winter rain pools in wooded areas on or near the Helfer Ranch at Caspar (3 mi. N. Mendocino), Mendocino Co., California. This locality is also the type locality for *S. bidessoides* (Leech) and *S. adelardi* (Rochette). These three species are known from no other localities. This suggests that either the species have extremely limited distribution or alternatively that the habitat is poorly studied. One specimen of *S. bidessoides*, (CASC) was taken in August, 1954 by Berlese funnel extraction of "moss in bed of dried up woodland pool". Most of the remainder of the specimens, of all species, have been taken from December to April. Further investigation of the fauna of these winter rain pools at other localities may well show these species to be more widespread.

Ecology. Label data on the type series record this species from winter rain pools and a pond in the woods. This species may be a winter active species (see Comments above).

Distribution. Known only from the type locality in Mendocino Co., California.

Genus *Heterosternuta* Strand 1935

Fig. 23F, 49

Heterosternus Zimmermann 1919: 156,161,178. Type species - *Hydroporus concinnus* LeConte, designated by Guignot (1942). Preoccupied.

Heterosternuta Strand 1935: 291. New name for *Heterosternus* Zimmermann.

Heterostethus Falkenström 1938: 8. New name for *Heterosternus* Zimmermann; junior homonym of *Heterostethus* Schwarz 1896.

Diagnosis. Length = 2.7 to 4.6 mm. Body in dorsal aspect with outline continuous, narrow and elongate-oval to subparallel medially, elytra relatively narrowly pointed apically; somewhat depressed (Fig. 49A – H).

Most specimens with dorsal surface maculate; pronotum yellow to reddish with darker markings along basal and apical margins, or entire disc infuscate; elytron yellow laterally with sutural and basal margins piceous and with medial and subapical transverse fasciae which are generally broadly confluent with dark sutural area and may

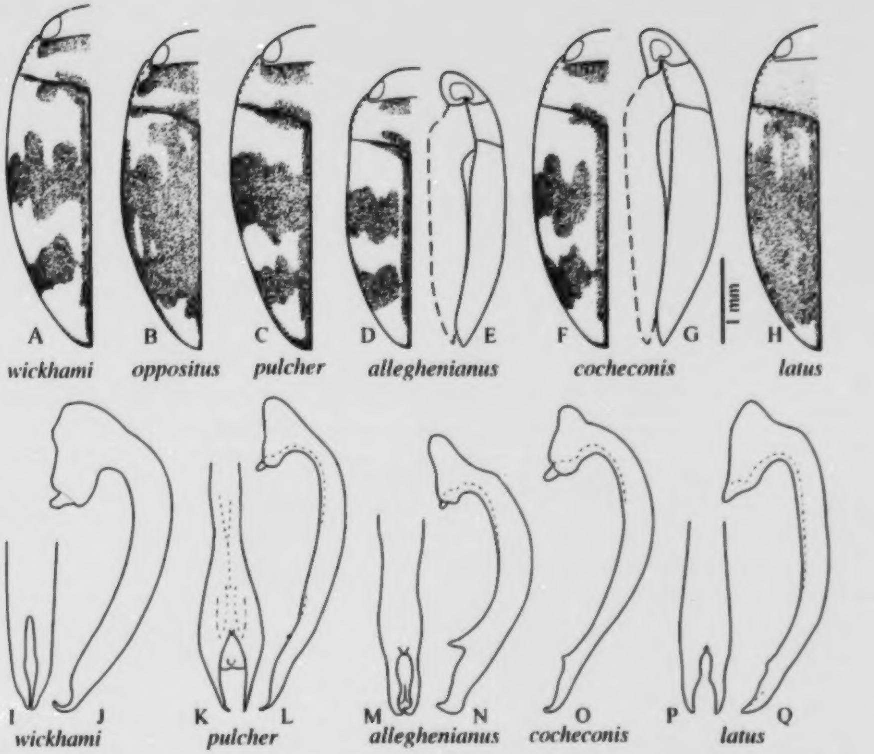


Fig. 49. *Heterosternuta*. A – H - left body outline. A - *H. wickhami* dorsal. B - *H. oppositus* dorsal. C - *H. pulcher* dorsal. D – E - *H. alleghenianus*, D - dorsal, E - lateral, F – G - *H. cocheconis*, F - dorsal, G - lateral, H - *H. latus* dorsal. I – Q, aedeagus. I – J - *H. wickhami*, I - ventral, J - lateral. K – L - *H. pulcher*, K - ventral, L - lateral. M – N - *H. alleghenianus*, M - ventral, N - lateral. O - *H. cocheconis* lateral. P – Q - *H. latus*, P - ventral, Q - lateral.

or may not be longitudinally contiguous with each other, some specimens with dark markings expanded and elytral disc largely black; ventral surface entirely rufous to variously darkened. Dorsal surface microreticulate; punctation fine to distinct; setae present but short and fine, inconspicuous on many specimens.

Clypeus with anterior margin not modified. Pronotum without a sublateral longitudinal impressed line or crease on each side; lateral bead relatively broad, dorsally flattened and widened anteriorly. Elytron in lateral aspect with side margin almost straight to shallowly sinuate and ascendant to humeral angle; epipleuron without a carina on shoulder; without a subapical lateral tooth; ventral surface with sublateral ridge low, slightly widened subapically but not forming a ligulate expansion. Metacoxal processes (Fig. 23F) conjointly with hind margin sinuate, emarginate on each side of midline which is evidently produced. Metatrochanter relatively large. Metafemur with ventral face sparsely punctate.

Male protarsomeres only slightly broadened, male best identified by presence of small scales on ventral surface of protarsomere 1; anterior protarsal claw more arcuate basally than posterior claw. Aedeagus slender, apex deeply emarginate in dorsal aspect, dorsal groove completely open or closed near base by a sclerotized bridge.

Comments. The genus has been revised by Matta and Wolfe (1981), who treated *Heterosternuta* as a subgenus of *Hydroporus*. Matta and Wolfe (1981) recognized 13 species but undescribed species still exist. This is a homogeneous group characterized by a uniform habitus, generally bright colors and apically bifid aedeagus. These beetles are probably related to members of *Neoporus* as Fall (1923) placed these two groups together in his *pulcher-undulatus* group of *Hydroporus*. Similarities between *Heterosternuta* and *Neoporus* exist in color pattern, flattened and apically widened pronotal bead, and occurrence in typically lotic habitats. Alarie (1991, 1992) listed five features of *Heterosternuta* and *Neoporus* larvae which suggest that they are sister groups. These beetles resemble members of *Sanfilippodytes* in the shape of the metacoxal processes, large metatrochanters, apically emarginate aedeagus (some species of *Sanfilippodytes*) and similarities in habitat, that is occurrence on mineral substrates and tendency to occur under cover or in crevices and spaces amongst rocks. However these similarities are probably convergences related to a similar habitat and not indicative of relationship for the aedeagi are quite different in general shape and other features differ.

The species of this Nearctic genus are restricted to the eastern half of North America with the centre of diversity being the Appalachian Mountains. The beetles occur along the margins of streams, in springs, and along rocky margins of gravel-pit pools and lakes. For the most part they occur on mineral substrates where they are found in gravel, under rocks or in crevices and in leaf packs, among exposed roots and in trailing vegetation. Matta and Wolfe (1981) stated the beetles are often common in temporary streams, but in Canada most specimens have been found in permanent streams or streams that maintain interconnected pools during dry spells.

Key to species of *Heterosternuta* of Canada and United States

(from Matta and Wolfe 1981, modified by G. W. Wolfe)

1. Prosternum with dense tufts of thickened, erect setae anterior to procoxae 2

1'. Prosternum lacking such tufts of setae anterior to procoxae 8

2(1). Large, length = 4.2 to 4.6 mm; metacoxae with intralinear space densely setose; male antennomeres 5 to 8 distinctly broadened and flattened; Kansas to Texas . . . . *H. diversicornis* (Sharp 1882*a*)

2'. Smaller, length = 2.7 to 4.1 mm; metacoxae with intralinear space punctate but setae inconspicuous; male antennomeres not dilated 3

3(2). Pronotum uniformly reddish-brown; elytron dark medially, medial transverse pale fascia absent or evident as a slight widening of pale lateral band; aedeagus with lateral margins near base with minute denticles, apex with sides of apical emargination very elongate and slender; length = 3.1 to 3.5 mm; Tennessee . . . .*H. jeanneae* (Wolfe and Matta 1979)

3'. Pronotum medially with a variously developed transverse pale area; elytron with a medial transverse pale fascia or at least medial pale discal spots; aedeagus without lateral denticles, apex less elongate 4

4(3). Aedeagus in dorsal aspect with dorsal groove closed near base by a sclerotized bridge, with a ventral projection at base of apical emargination; metacoxal punctation coarse; ventral surface yellowish or orangish 5

4'. Aedeagus with dorsal groove open for its entire length, lacking a ventral projection at base of apical emargination; metacoxal punctation finer; ventral surface usually with extensive darkening, at least laterally . . .7

5(4). Length 3.7 to 4.2 mm; aedeagus trifid, with three extremely long apical projections, length of each projection approximately one-quarter length of aedeagus; tributaries to Buffalo River, Ozark Mountains, north central Arkansas . . . . *Heterosternuta* new species

5'. Length 3.1 to 3.7 mm; aedeagus not distinctly trifid, without three extremely long apical projections 6

6(5). Length = 3.1 to 3.4 mm; head orangish to reddish; aedeagus in lateral aspect with apex distad of ventral subapical projection almost straight or slightly curved; Great Lake States and Pennsylvania south to Tennessee and Virginia . . . . *H. ohionis* (Fall 1917)

6'. Length = 3.0 to 3.7 mm; head more yellowish; aedeagus in lateral aspect with apex distad of ventral subapical projection strongly curved, ventrally deflected almost 90 degrees; Tennessee . . . . *H. jenniferae* (Wolfe and Matta 1979)

7(4). Ventral surface extensively infuscate, metasternum more or less uniformly piceous to black; elytron and metacoxal plate with punctation finer; aedeagus (Fig. 49I, J) in lateral aspect with shaft more or less straight apically, apex abruptly narrowed to a strongly ventrally curved finger-like process . . . . 1. *H. wickhami* (Zaitzev)

7'. Ventral surface less deeply infuscate, metasternum medially rufous to piceous and paler than metasternal wings in most specimens; elytron and metacoxal plate more coarsely punctate; aedeagus in lateral aspect with apical third reflexed ventrally and its ventral margin distinctly sinuate, apex gradually narrowed and slightly to distinctly curved ventrally . . . . 2. *H. oppositus* (Say)

8(1). Epipleuron, metacoxal plates and sterna 1 and 2 finely and densely punctate, their surfaces appearing more or less granulate at low magnification . . . . 3. *H. pulcher* (LeConte)

8'. Metacoxal plate and sterna 1 and 2 with punctures large and discrete, epipleuron obsoletely punctate 9

9(8). Pronotum uniformly dark reddish or brown or with yellow markings reduced to very small spots 10

9'. Pronotal disc yellow medially, with infuscation of various width across anterior and posterior margins 11

10(9). Aedeagus in dorsal aspect with apical emargination very narrow, apex acute and needle-like; with a distinct prong-like ventral projection at base of apical emargination; length = 2.9 to 3.5 mm; Arkansas and possibly southern Missouri, southwestern Kansas, eastern Oklahoma and Texas. . . . .*H. sulphurius* (Matta and Wolfe 1979)

10'. Aedeagus (Fig. 49P, Q) in dorsal aspect with apical emargination broad, apex blunter and more or less bifid; in lateral aspect with a low, obtuse projection at base of apical emargination; length = 3.1 to 3.3 mm; New York, Ohio and Indiana to Tennessee . . . .*H. laetus* (Leech 1948)

11(9). Aedeagus (Fig. 49M, N) in lateral aspect with side piece of apical emargination broad and more or less distinctly inflated at base of apical hook; elytron in lateral aspect with lateral margin slightly arcuate and ascendant to humeral angle; body subparallel, relatively strongly depressed; elytron with punctation fine; antenna entirely yellow or with apical antennomere lightly infuscate; length = 2.6 to 3.3 mm; southeastern Canada to North Carolina and Tennessee . . . . .4. *H. allegheniamus* (Matta and Wolfe)

11'. Aedeagus (Fig. 49O) in lateral aspect with side piece of apical emargination narrow and tapering towards apex; elytron in lateral aspect with lateral margin more or less straight; body form more ovate and less strongly depressed; elytron punctation various; antenna of many specimens with apical antennomere darkly infuscate 12

12(11). Distribution Canada and northeastern United States . . . . 5. *H. cocheconis* (Fall)

12'. Distribution southeastern United States and Ozark region west of Mississippi River 13

13(11). Distribution Alabama; metacoxal punctation extremely coarse; aedeagus in dorsal aspect with side pieces of apex closely appressed and together sharply pointed apically; length = 3.0 to 3.4 mm . . . .*H. folkertsi* (Wolfe and Matta 1979)

13'. Distribution Ozark region, Arkansas, Oklahoma and Texas; metacoxal punctation distinctly finer; aedeagus with side pieces of apex evidently separated and each bluntly pointed or rounded apically; length = 2.8 to 3.2 mm . . . .*H. ouachitus* (Matta and Wolfe 1979)

1. *Heterosternuta wickhami* (Zaitzev 1907)

Fig. 49A, I, J

Hydroporus wickhami Zaitzev 1907: 114. Type locality - Fort Laramie, Wyoming.

Selected References. Matta and Wolfe 1981: 217 – 218; Hilsenhoff 1995: 4.

Description. Length = 3.2 to 3.7 mm; width = 1.6 to 1.8 mm; length: width = 2.00 to 2.09. Body (Fig. 49A) elongate oval, widest at middle; pronotum and elytra continuous and evenly curved in dorsal aspect.

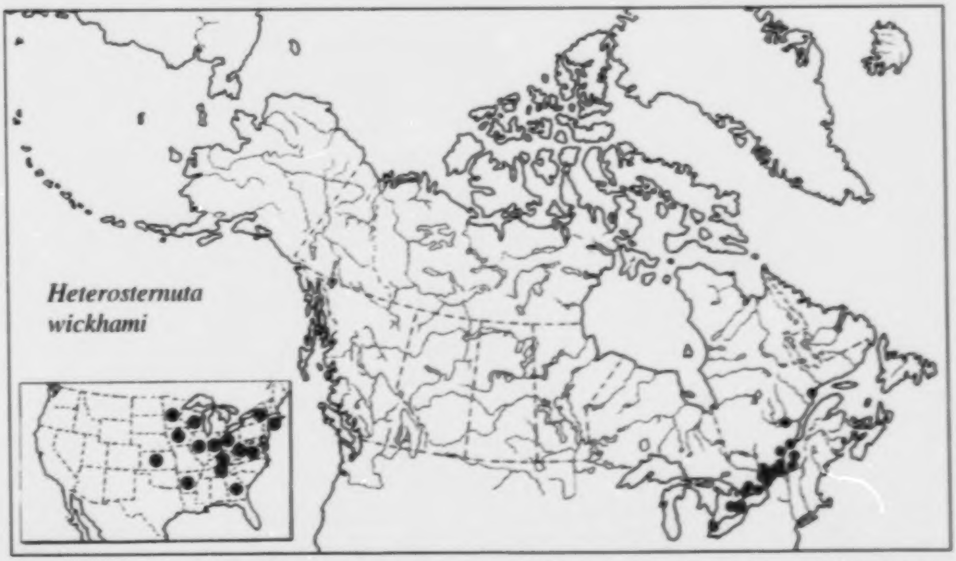
Head rufous; antenna yellow with at least apical antennomere deeply infuscate; palpi yellow. Pronotum rufous with disc broadly piceous along anterior margin, hind margin faintly infuscate. Elytron yellow with brown to black basal and sutural margins and transverse medial and subapical fasciae. Ventral surface with meso- and metathorax, and metacoxal plates, piceous to black, metasternum as dark medially as laterally; abdominal sterna dark rufous to brown or piceous. Legs red.

Dorsal surface reticulate, punctation fine. Metasternal wing coarsely punctate; metacoxal plate and sterna 1 and 2 with punctures finer but distinct, subequal; epipleuron with punctation fine to obsolete.

Elytron with lateral margin gradually ascendant and faintly sinuate behind humeral angle. Prosternum just anterad to each procoxa with a dense brush of short, stiff, erect brown setae; file and prominence well developed. Metasternum not or only faintly longitudinally impressed medially.

Male protarsomeres 1 to 3 evidently broadened; anterior protarsal claw abruptly arcuate at base and straight in apical half, ventral margin slightly sinuate. Aedeagus (Fig. 49I, J) in lateral aspect with apex abruptly narrowed to a ventrally hooked finger-like process; in ventral aspect apical emargination long and slender, without a spine at its base.

Ecology. This species occurs in gravel along the margins of streams. Matta and Wolfe (1981) state it is most common at the margin of medium to small streams. We have also collected specimens from springs near Ottawa where the beetles were among emergent plants growing on organic silt and sand. The larva has been described by Barman (1972) and Alarie (1991, 1992).



Map 66. *Heterosternuta wickhami* (Zaitzev). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 66. The species occurs from southern Ontario and Quebec south to northern Georgia, and west to Wisconsin and Kansas. Matta and Wolfe (1981) noted that although the type was reported to be from Wyoming, they had not seen specimens from that far west.

2. *Heterosternuta oppositus* (Say 1823)

Fig. 49B

Hydroporus oppositus Say 1823: 102. Neotype - Pendleton Co., West Virginia (Matta and Wolfe 1981).

Selected Reference. Matta and Wolfe 1981: 211 – 213.

Description. Length = 3.1 to 4.1 mm; width = 1.5 to 2.1 mm; length: width = 2.00 to 2.11. Similar to *H. wickhami*, elongate-oval, widest at middle (Fig. 49B).

Head testaceous, slightly darkened behind eyes and across vertex; antenna yellow with at least apical antennomere infuscate; palpi yellow. Pronotum rufotestaceous laterally and in posterior half, broadly piceous along anterior margin, hind margin with infuscation narrower and less distinct, on some specimens contacting anterior infuscate area medially. Elytron with typical fasciate pattern or dark areas expanded and pale areas reduced to basal, lateral and subapical spots. Ventral surface with color various, darkly infuscate with metasternum and metacoxa medially, and abdominal sterna lighter, rufous to rufopiceous.

Elytron with punctures separated by 1 to 1.5 times their own width. Ventral surface with punctures separate and distinct; coarsest on metasternal wings, finer on metasternum medially and metacoxal plates.

Elytron gradually ascendant to humeral angle in lateral aspect, slightly sinuate behind shoulder. Prosternum with a tuft of stiff, erect setae anterior to each coxa; prosternal file and prominence well developed. Metasternum not or only slightly longitudinally impressed medially

Male with anterior protarsal claw broadly curved basally, apical half straight, slightly to strongly sinuate ventrally. Aedeagus in ventral aspect more or less evenly narrowing from level of base of apical emargination to apex, in lateral aspect apical third reflexed downwards and ventral margin bisinuate in lateral aspect; without a knob or spine at base of apical emargination.

Comments. Matta and Wolfe (1981) noted that specimens from northern parts of the species range differed from southern specimens in that they tend to be smaller, darker and with less sinuate protarsal claws than southern specimens. The description and key are based on specimens from New York state.

Ecology. Matta and Wolfe (1981) report specimens occur in gravel at the margins of streams and are most common in small and intermittent streams.

Distribution. We have not seen Canadian specimens although Matta and Wolfe (1981) give the range as eastern Canada (without specific localities) and New England south to North Carolina and Tennessee.

3. *Heterosternuta pulcher* (LeConte 1855)
Fig. 49C, K, L

Hydroporus pulcher LeConte 1855: 298. Type locality - Alabama.

Seleceted References.. Matta and Wolfe 1981: 214 – 215; Hilsenhoff 1995: 4.

Description. Length = 3.2 to 3.7 mm; width = 1.6 to 1.9 mm; length: width = 1.94 to 2.07. Body (Fig. 49C) with point of maximum width on average more anterior than in related species, elytra more evidently pointed behind

Head testaceous to red; antenna pale with at least antennomere 11 infuscate apically; palpi pale. Pronotum pale rufous with anterior and posterior margins piceous to black. Elytron maculation various, some specimens with disc almost entirely black, others with elytron yellow except base, sutural margin, and medial and subapical fascia, dark; medial and subapical fascia joined laterally on most specimens. Ventral surface pale to dark rufous or rufopiceous.

Dorsal surface reticulate and finely punctate. Metasternal wings with moderate sized, distinct punctures; metacoxal plate, especially laterally, epipleuron and sterna 1 and 2 finely and densely punctate giving surfaces a granular appearance.

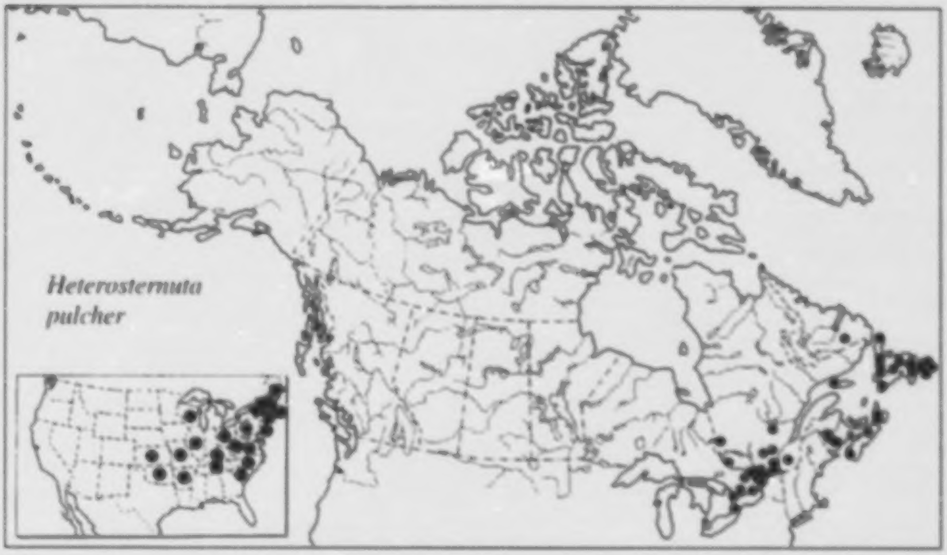
Elytron with lateral margin more or less straight in lateral aspect. Prosternum lacking tufts of setae anterior to coxae; file and prominence evident. Metasternum with midline only faintly and broadly impressed, sides smoothly rounded laterally.

Male anterior protarsal claw strongly bent at base, more or less straight to slightly arcuate apically. Aedeagus (Fig. 49K, L) slender in lateral aspect, flattened apically, apex shortly curved, subapical spine small; in dorsal aspect subapically broadened.

Comments. This species shows considerable interpopulation variation in size and color. No pattern was observed in length variation. However, color varies, at least in part, in relation to the predominant color of the substrate on which the beetles occur. For example, specimens from streams crossing the limestone barrens of the northwestern Great Northern Peninsula, Newfoundland, where substrates are pale yellow, have the pale elytral pattern greatly expanded. On the other hand, specimens from streams with dark substrates or in which rocks are largely covered with dark precipitates, have much more extensive black maculation and many specimens have almost completely black elytra.

Ecology. Specimens occur on mineral substrates, such as clay, sand or gravel along the margins of various sized streams, as well as along lake shores and in quarry pools.

Distribution. Map 67. The range extends from Newfoundland and southern Labrador to Ontario, and south to South Carolina and Oklahoma.



Map 67. *Heterosternuta pulcher* (Fall). Canadian and Alaskan collection localities and United States state records.

4. *Heterosternuta alleghenianus* (Matta and Wolfe 1979)

Fig. 49D, E, M, N

Hydroporus alleghenianus Matta and Wolfe 1979: 291. Type locality - Bath Co., Virginia.

Description. Length = 2.8 to 3.3 mm; width = 1.4 to 1.6 mm; length: width = 2.08 to 2.21. Body (Fig. 49D, E) elongate, elytra at widest point only slightly wider than pronotum across hind angles; elytra in basal half almost parallel sided, slightly sinuate or concavely impressed behind humeral angles in dorsal aspect; relatively strongly depressed.

Head entirely reddish yellow; antenna yellow, apical antennomere lightly infuscate on some specimens; palpi yellow. Pronotum reddish yellow with a diffuse piceous spot medially on anterior margin; basal margin with a faint brownish spot each side of middle. Elytron testaceous with basal margin medially and sutural margin piceous; disc with a medial and a subapical transverse piceous fascia, these separated from or narrowly contiguous with piceous sutural margin. Ventral surface and legs reddish yellow.

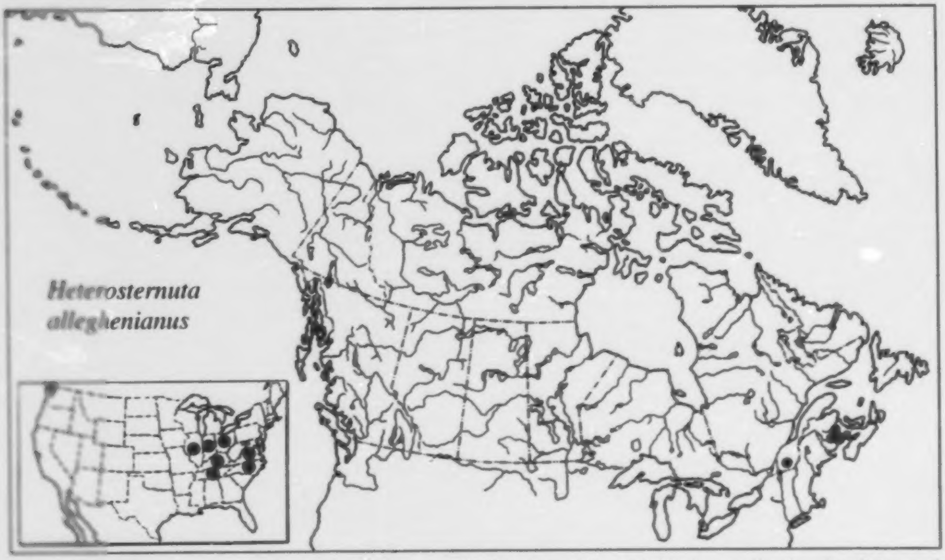
Dorsal surface evidently microreticulate. Head with small punctures dense medially on frons, sparser laterally. Pronotum with small punctures more or less evenly distributed on disc, punctures scarcely larger towards basal and lateral margins. Elytron with punctures small and shallow, subequal to those of the pronotum and smaller than serial punctures, punctation largely obscured by reticulate sculpture. Metasternal wing coarsely punctate; metacoxa with punctures coarse but smaller, decreasing in size posteriorly, more or less uniformly distributed; sterna 1 and 2 with punctures on average smaller than those of hind portion of metacoxal plate; metasternum medially with punctures small but relatively dense.

Pronotum with lateral bead broad, widening anteriorly and subequal in width to base of an antennomere. Elytron in dorsal aspect with lateral margin slightly concave posterad to shoulder; in lateral aspect margin slightly arcuate and ascendant to humeral angle, epipleuron visible to or almost to shoulder (Fig. 49E). Prosternum with file weak, prominence evident; setal tufts absent from anterior margin of procoxal cavities. Metasternum with medial line lightly impressed, sides rounded on each side of line.

Male anterior protarsal claw with ventral surface slightly broadened medially. Aedeagus (Fig. 49M, N) in lateral aspect with apex broadened, recurved and hooked; ventral subapical spine at base of apical emargination long; shaft not constricted basad of spine.

Ecology. Matta and Wolfe (1981) state the species occurs in very small (possibly intermittent) streams. The beetles occur on pebble substrates or in leaf litter along the margin of streams, in protected embayments and in isolated pools adjacent to the stream. Teneral specimens were collected in August.

Distribution. Map 68. The range extends from New Brunswick and southern Quebec to North Carolina and Tennessee.



Map 68. ***Heterosternuta alleghenianus*** **(Matta and Wolfe). Canadian and Alaskan collection localities and United States state records.**

5. *Heterosternuta cocheconis* (Fall 1917)

Fig. 49F, G, O

Hydroporus cocheconis Fall 1917: 171. Type locality - Cocheco River, Farmington, New Hampshire.

Selected Reference. Matta and Wolfe 1981: 193 – 196.

Description. Length = 2.7 to 3.7 mm; width = 1.3 to 1.8 mm; length: width = 2.00 to 2.17. Body (Fig. 49F, G) elongate; elytra subparallel basally, widest at middle; pronotum and elytra continuous in curvature in dorsal aspect or elytra slightly impressed at sides basally.

Head reddish yellow; antenna yellow with apical antennomere infuscate apically; palpi yellow. Pronotum reddish, broadly piceous along anterior margin; basal margin with infuscation narrow. Elytron with basal and sutural margins piceous, with broad medial and postmedial transverse piceous fasciae, fasciae separated laterally but longitudinally connected medially on disc of many specimens. Ventral surface and legs reddish.

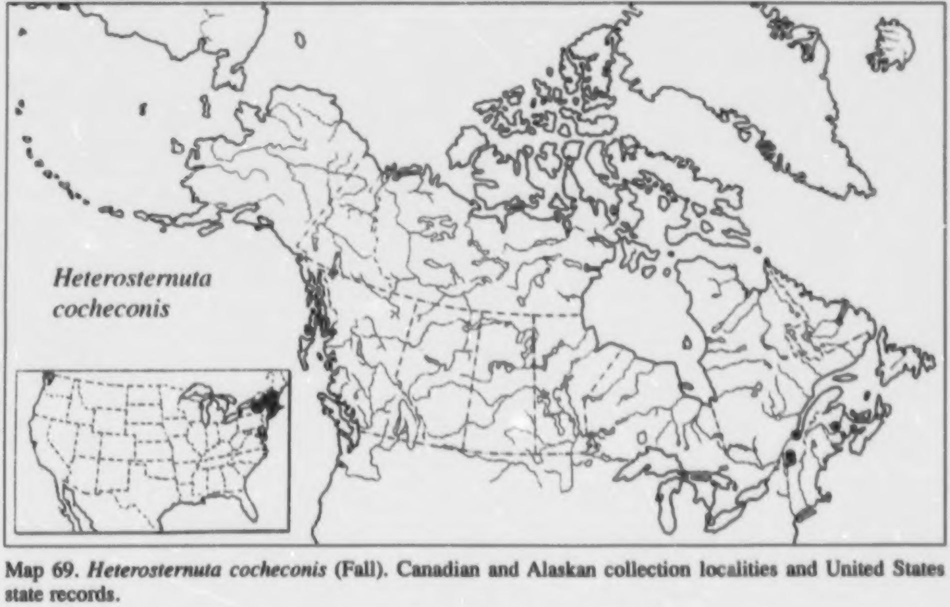
Dorsal surface evidently reticulate. Head with punctures more or less evenly distributed on frons. Pronotum evidently punctate over disc, punctures somewhat denser towards margins. Elytron with punctures similar in size or larger than those on base of pronotum. Ventral surface coarsely punctate, metasternum medially and interlinear space of metacoxa conspicuously punctate; metasternal wing coarsely punctate; metacoxal plate with punctures coarse, largest anteriorly with punctures becoming smaller posteriorly where they are subequal in size to sternal punctures.

Elytron with lateral margin almost straight in lateral aspect, epipleuron disappearing posterad of shoulder (Fig. 49G). Prosternal file and prominence evident; without a group of stiff setae anterior to procoxae. Metasternum medially with longitudinal impression limited on each side by an evident convexity.

Male anterior protarsal claw slightly broader and more arcuate than posterior. Aedeagus (Fig. 49O) with dorsal groove broadly closed by a sclerotized bridge near base, with a ventral spine at base of emargination, apex broadened and strongly curved ventrally.

Comments. This species may be composite. Specimens from New Brunswick differ from Quebec specimens as follows: color darker with the dark basal margin of the pronotum the dark elytral fasciae broader; punctation of elytra slightly coarser; and aedeagus apex broader and more strongly reflexed, subapical spine larger.

Ecology. Specimens were collected from backwaters and embayments along the margin of a small, sand and gravel bottomed stream. Matta and Wolfe (1981) state specimens occur at the gravelly margins of small streams in sites protected from the current or in trailing vegetation.



Map 69. ***Heterosternuta cocheconis*** **(Fall). Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 69. The range extends from central New Brunswick and southern Quebec to central New York and Connecticut.

Genus *Lioporeus* Guignot 1950
Fig. 50

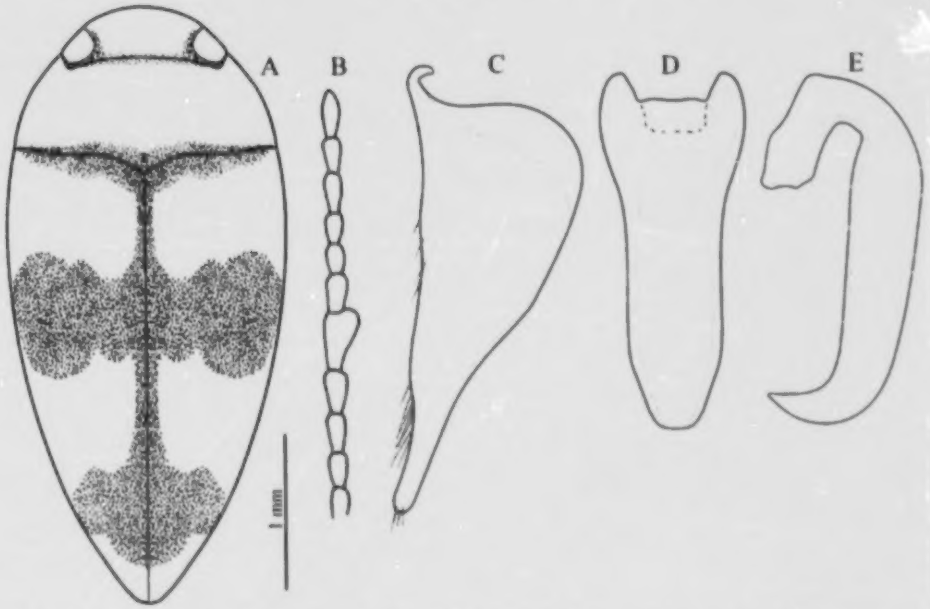


Fig. 50. *Lioporeus triangularis* male. A - body outline, dorsal. B - antenna. C - paramere. D - aedeagus, dorsal. E - aedeagus, lateral.

Lioporeus Guignot 1950: 101. Type species - *Lioporeus brownei* Guignot (= *Hydroporus triangularis* Fall), by monotypy. (Wolfe 1983).

Falloporus Wolfe and Matta 1981: 153 - 164. Type species - *Hydroporus triangularis* Fall, original designation.

Diagnosis. Size moderate, length = 3.8 to 4.3 mm; body outline (Fig. 50A) continuous in dorsal aspect, shape elongate oval, apex of elytra rather narrowly pointed. Color yellow to reddish with variously developed dorsal maculation. Microreticulation present over dorsal surface; dorsal surface finely punctate; setae inconspicuous.

Clypeus with anterior margin not modified. Pronotum without a sublateral longitudinal impressed line or crease on each side; lateral bead narrow. Elytron in lateral aspect with lateral margin straight; epipleuron lacking a humeral carina; ventrally without a distinct ligula; without a subapical lateral tooth. Prosternal process elongate, bluntly pointed apically, widely margined laterally and with a well developed medial ridge. Metacoxal processes conjointly with hind margin sinuate, emarginate each side of medial line which is produced. Metatrochanters of moderate size. Metafemur with ventral face sparsely punctate.

Male antennomeres 4 or 4 and 5 variously broadened or expanded on anterior margin (Fig. 50B). Protarsus slightly dilated, protarsomere 1 with a ventral cupule containing many short sensillae. Aedeagus (Fig. 50D, E) shorter than parameres, apex entire, pointed and deflected ventrally; parameres (Fig. 50C) symmetrical, broad basally and narrowing to apex in lateral aspect, with long subapical setae.

Comments. This Nearctic genus has been revised by Wolfe and Matta (1981). The two included species have an aggregate range which covers much of the United States east of the Great Plains. There are no Canadian records although the more northerly species, *L. triangularis* (Fall), occurs north to New York and Wisconsin.

Key to species of *Lioporeus*
(modified from Wolfe and Matta 1981)

1. Male antenna with only antennomere 5 broadened apically (Fig. 50B); pronotum with infuscation restricted to apical and basal margins; eastern United States south to southern Gulf Coastal Plain ....1. *L. triangularis* (Fall)

1'. Male with antennomere 4 and 5 distinctly broadened apically; pronotum with disc extensively infuscate; Gulf and Atlantic coasts, north to Tennessee and North Carolina .... *L. pilatei* (Fall 1917)

1. *Lioporeus triangularis* (Fall 1917)
Fig. 50

Hydroporus triangularis Fall 1917: 170. Type locality - Sauk City, Wisconsin. Type in MCZC (Wolfe and Matta 1981).

Selected References. Wolfe and Matta 1981: 149 – 175; Wolfe 1983: 1547 – 1548; Hilsenhoff 1994: 290.

Description. Length = 3.4 to 4.3 mm; width = 1.6 to 2.1 mm; length: width = 2.09. Body (Fig. 50A) with point of maximum width near base of elytra, elytra pointed apically.

Head reddish yellow, some specimens vaguely infuscate mesad to each eye. Pronotum yellowish to pale reddish, with anterior and posterior margins narrowly infuscate on most specimens. Elytron yellow with variously developed maculation, most specimens with dark sutural margin, basal margin and a medial and a subapical fascia; palest specimens with only medial and subapical fasciae present and represented by one or several spots; darkest specimens with entire disc except elytral apex, dark. Ventral surface pale reddish.

Microreticulation present over dorsal surface. Dorsal surface finely punctate. Metasternum and metacoxa with coarser scattered punctures.

Male with antennomere 5 distinctlly broadened, antennomere 4 not modified (Fig. 50B); aedeagus (Fig. 50D, E) short and broad, abruptly bent ventrally towards apex, apex entire, dorsal groove open to base.

Ecology. These beetles occur along the margins and under undercut banks of small, clear streams.

Distribution. The range extends from New York and Wisconsin, south to northern Florida. There are no Canadian records but the species occurs in bordering states.

Genus *Neoporus* Guignot 1931

Figs. 23C; 51 – 61

Neoporus Guignot 1931*a*: 46. Type species - *Hydroporus hebes* Fall 1923, original designation.

Circinoporus Guignot 1945: 22. Type species - *Hydroporus cimicoides* Sharp 1882*a*, original designation.

Diagnosis. Small to medium hydroporinae, length = 2.2 to 6.4 mm. Most specimens brightly colored with head, pronotum and ventral surface of body yellow to pale reddish, elytron maculate; however, some specimens with most of pronotal disc, elytra except lateral margins, and much of ventral surface piceous to black. Dorsal surface with sculpture various, microreticulation strong to variously effaced; punctation fine to strong; most specimens distinctly setose.

Clypeus unmodified or variously thickened and produced anteriorly. Pronotum without a sublateral longitudinal impressed line or crease on each side; lateral bead various, on most specimens broad, widened and dorsally flattened towards anterior angle. Elytron in lateral aspect with lateral margin almost straight to strongly ascendant at humeral angle; epipleuron lacking a carina on shoulder; ventral surface with submarginal ridge produced into a small triangular ligula apically; lacking a subapical lateral tooth. Prosternal prominence variously developed, smoothly and obtusely rounded to strongly angulate and projecting; prosternal process generally broad, elongate and bluntly pointed apically, with a distinct medially rounded longitudinal carina or ridge. Metacoxal processes (Fig. 23C) conjointly with hind margin angulate medially, not evidently emarginate each side of midline. Metatrochanter of moderate length. Metatibia sparsely punctate ventrally.

Male antenna not modified. Protarsus not to evidently dilated, protarsomeres 1 and 2 with enlarged adhesive scales ventrally; protarsal claws modified or not, most specimens with anterior claw slightly more arcuate basally than posterior claw. Aedeagus subequal in length to parameres, its apex simple. Parameres symmetrical, triangular without apical lobe or hook (Fig. 51D).

Comments. This endemic Nearctic genus contains approximately forty species (Wolfe 1984), most of which are restricted to the Appalachian region of eastern North America. The majority of the Canadian species occur east of the Great Plains although two species have ranges that extend west of the Rocky Mountains.

The genus *Neoporus* constitutes the *undulatus* section of Fall's (1923) *Hydroporus pulcher-undulatus* species group. Fall's treatment of the group is generally very good but he did recognize problems in species definition in several species complexes. Also, a number of species have been described subsequently by Young (1940, 1967*b*, 1978, 1984) and Wolfe (1984). Wolfe (1984) published the first part of a revision in which he defined nine species groups and revised the members of the *N. vittatipennis* group. Epler (1996) provided an up to date review of the Florida species. In the following treatment, species have been defined rather broadly so that it is possible that some species, especially *N. undulatus*, are composite. Also, not all species recorded from the northeastern United States have been included because we have not been able to recognize some species in collections and are not certain of their status. However, all easily recognized northern United States species are treated in the key to species.

These beetles are generally associated with flowing water. Some species occur along the banks of rather swiftly flowing small streams, but the majority occur in protected sites or depositional areas. Specimens have been collected in lentic situations such as along lake shores or newly formed reservoirs, usually where there are firm substrates and often some water movement through wave action, or from beaver ponds, a lentic habitat but one in which flushing and some water movement occurs. A few species occur on peaty substrates in springs or peatland streams.

Key to species of *Neoporus* of Canada and northern United States

(key by D. Larson and W. G. Wolfe)

1. Clypeus with anterior margin squarely truncate to concave, with prominent right angled to acute anterolateral angles; eyes very large; pronotum with lateral bead narrow, of uniform width throughout; elytron with lateral margin strongly ascendant to humeral angle; length = 3.4 to 5.0 mm 2

1'. Clypeus with anterior margin broadly convex, with anterolateral angles more rounded and obtuse; eyes normal; pronotum with lateral bead various, on most specimens distinctly widened anteriorly; elytron with lateral margin more or less straight or slightly ascendant to humeral angle; length various 3

2(1). Smaller, length = 3.4 to 4.0 mm; metasternum and metacoxal plates shiny, without microreticulation; metacoxal processes conjointly with hind margin distinctly produced medially; Illinois and Wisconsin to Florida . . . . *N. hybridus* (Aubé)

2'. Larger, length = 4.1 to 5.0 mm; metasternum and metacoxal plates with microreticulation; metacoxal processes with hind margin almost truncate; New Jersey to Florida . . . . *N. venustus* (LeConte)

3(1). Large species, length = 5.5 to 6.4 mm; Indiana to Florida and Texas . . . . *N. aulicus* (Aubé)

3'. Smaller species, length = 2.2 to 5.0 mm 4

4(3). Elytron with three broad longitudinal bands of very coarse punctures, bands separated from each other and margins by narrower finely punctate areas; metathorax very coarsely punctate laterally; length = 3.1 to 3.4 mm; Vermont and Michigan to Florida and Alabama . . . . *N. striatopunctatus* (Melsheimer)

4'. Elytron with discal punctures more or less regular or becoming finer apically and laterally, without broad longitudinal bands of coarse punctures (excluding more or less linear series of serial punctures); length various 5

5(4). Length = 2.2 to 3.3 mm; pronotum with lateral bead very narrow, not widened anteriorly nor flattened dorsally; prosternum in lateral aspect gradually descendant to prosternal process without a prominence or protuberance 6

5'. Length greater than 3.0 mm; pronotum with lateral bead on most specimens distinctly widened and flattened towards anterolateral angle; prosternum in lateral aspect with an angulate prominence or protuberance at base of prosternal process 11

6(5). Larger, length = 2.6 to 3.3 mm; if length less than 2.7 then length: width greater than 2.0 7

6. Smaller, length = 2.2 to 2.7 mm 9

7(6). Body rather broad and distinctly more oval, length: width less than 1.85; elytral vittae rather suffused and coalesced; elytron with strigations evident when viewed obliquely due to effaced areas; Tennessee to Northern Florida and Alabama . . . . *N. dixianus* (Fall 1917)

7. Body more elongate oval, length: width greater than 1.95; elytral vittae more distinct, less suffuse and interconnected; elytral reticulation less effaced 8

8(9) Subhumeral spot never present; ventral punctation irregular, punctures separated by 1 to 3 times their width; length: width greater than 2.0; ventral edge of aedeagus not arcuate in lateral view; Kansas, Oklahoma, and Texas . . . . *N. pratus* (Wolfe 1984)

8. Subhumeral spot always present, sometimes coalesced with lateral vittae; metacoxal punctation more evenly spaced, punctures separated by 1 to 1.5 their width; length: width greater than 2.0; ventral edge of aedeagus arcuate in lateral view ; North Carolina to Illinois and south to Gulf Coast. . . . . *N. vittatipennis* (Gemminger and Harold 1868)

9(6). Elytron with subhumeral with an isolated humeral spot or with expanded lateral extension of discal maculation; body short and broad, length: width = 1.74 to 1.87; aedeagus in dorsal aspect with apex very broadly rounded (Fig. 51B, C); New Brunswick and southern Ontario, south to Florida and Texas . . . . .1. *N. mellitus* (LeConte)

9'. Elytron with subhumeral area lacking dark maculation 10

10(9). Metacoxal and elytral punctation coarser; apex of aedeagus rounded; length: width greater than 1.9; Tennessee and Alabama . . . . *N. latocavus* (Wolfe 1984)

10. Aedeagus evenly narrowed in apical third, apex pointed (Fig. 51E, F); length: width less than 1.9; New York and southern Ontario to Wisconsin, south to Tennessee and Kansas . . . . . .2. *N. tennetum* (Wolfe)

11(5). Length less than 3.5 mm; prosternal protuberance less distinct 12

11. Generally larger species, length greater than 3.5 mm, if less than 3.5 mm prosternal protuberance more distinct 13

12(11). Body with point of maximum width near base of elytra and anterior to midpoint of body (Fig. 52A); epipleuron and metacoxal plates with punctures fine, shallow, and widely spaced; aedeagus evenly tapering toward apex . . . . .3. *N. blanchardi* (Sherman)

12. Body with point of maximum width more posterior, across basal third of elytra; epipleuron and metacoxal plates with punctures distinctly coarser; aedeagus not evenly tapering toward apex, distinctly broader subapically; Indiana to Tennessee and Alabama . . . . *N. psammodytes* (Young 1978)

13(11). Metacoxal plate with punctures small, dense, and more or less even in distribution, punctures much smaller than coarse punctures of metasternal wing; ventral surface mainly brown or piceous; elytron brown to piceous with little contrasting discal and lateral pale spots; aedeagus with apex twisted in dorsal aspect (Fig. 53E) . . . . .4. *N. vitiosus* (LeConte)

13. Metacoxal plates with punctures coarse, subequal to or slightly smaller than those of metasternal wing, and much coarser than dorsal punctures; ventral surface of thorax yellow to brownish; elytral maculation various; aedeagus symmetrical in dorsal aspect 14

14(13). Elytron with longitudinal sulci on basal half (Fig. 54A), one subsuturally (indistinct on some specimens), a second in or adjacent to medial serial punctures and limited laterally by a distinct convex area, and some specimens with an additional one or two less distinct lateral sulci; ventral surface of thorax very coarsely punctate; antenna entirely yellow 15

14. Elytron without such longitudinal sulci, or some specimens with at most a vague subsutural series of punctures or impression; ventral surface variously punctate; antenna yellow, with or without apical infuscation 16

15(14). Elytron with 3 or 4 evident sulci, sulcus 2 distinct and limited laterally by a well defined convexity; length = 3.7 to 4.0 mm; aedeagus more or less evenly arcuate in lateral aspect (Fig. 54D, E) . . . . .5. *N. sulcipennis* (Fall)

15. Elytron with sulci shallow and best seen by examining elytron at an oblique angle, sulcus 2 limited externally by an evident but low convexity, and most specimens with only two sulci evident; length = 3.9 to 4.5 mm; aedeagus with a distinct angulate bend in middle (Fig. 55D, E) . . . . .6. *N. spurius* (LeConte)

16(14). Elytron with markings longitudinal, consisting either of distinct longitudinal dark vittae or pale lines some of which pass from basal half into apical half of disc, dark specimens with at least a subsutural pale stripe extending much of length of disc (Figs. 59A; 60A; 61A) . . 23

16. Elytral pattern consisting of transverse maculations or fasciae, a medial dark area separating pale areas in basal half from those in apical half except along lateral margin (Figs. 56A; 57A; 58A) (many specimens of N. shermani with a narrow subsutural pale stripe extending from basal area to beyond middle, male with anterior protarsal claw about one half length of posterior claw and truncate apically) 17

17(16). Antenna entirely yellow, without apical infuscation . . . . 7. *Neoporus dilatatus* (Fall)

17. Antenna yellow except at least apical antennomere infuscate apically 18

18(17). Male anterior protarsal claw three-quarters or less length of posterior claw (Fig. 56B) 19

18. Male protarsal claws subequal in length (Figs. 57B; 58B) 21

19(18). Male anterior protarsal claw three quarters length of posterior claw; anterior pronotal infuscation extending along almost entire width; Illinois and Indiana to Tennessee . . . . *N. semiflavus* (Fall 1917)

19. Male anterior protarsal claw one half length of posterior claw; anterior pronotal infuscation approximately one half to one third anterior width of pronotum 20

20(19). Male anterior protarsal claw acute apically (Fig. 56B); clypeus distinctly thickened and delimited from frons by a slight ridge; female with lateral margin of pronotum in dorsal aspect impressed and concave slightly behind anterolateral angle (Fig. 56A) . . . . .8. *N. clypealis* (Sharp)

20. Male anterior protarsal claw truncate apically; clypeus not noticeably thickened; female pronotum with lateral margin evenly rounded and not sinuate near anterolateral angle; New York to Kansas and Florida . . . . *N. shermani* (Fall 1917)

21(18). Elytron in dorsal aspect with lateral margin straight from base to about middle then broadly angulate and narrowed to apex; elytron dark brown to piceous, pale markings obscure; elytron very densely punctate. punctures for most part narrowly separated but tending to form more or less distinct irregular transverse series; ventral surface relatively coarsely punctate, metatrochanter distinctly punctate; New Jersey to Florida . . . . *N. cimicoides* (Sharp 1882*a*)

21. Elytron in dorsal aspect with lateral margin smoothly curved, without a distinct medial angulation; elytron color various but many specimens with distinct pattern of maculation; elytron less densely punctate; ventral surface with punctation various, metatrochanter with punctures small or indistinct 22

22(21). Metacoxal plate with punctures large, separated by distances subequal to their diameters; epipleuron with punctures fine and inconspicuous; antenna with antennomere 11 (also 10 on some specimens) infuscate . . . . 9. *N. carolinus* (Fall)

22. Metacoxal plates with punctures smaller and denser; epipleuron with punctures small, dense and conspicuous; antenna of most specimens with apical 4 to 6 antennomeres infuscate . . . . . . .10. *N. undulatus* (Say)

23(16). Elytron with three broad, longitudinal dark vittae, namely sutural, discal and sublateral (Fig. 59A); pronotum with lateral bead narrow and not or only slightly broadened at front angle . . . .11. N. vittatus (LeConte)

23. Elytron with vittae narrower, more numerous and more irregular (Figs. 60A; 61A); pronotum with lateral bead broadly expanded at front angle 24

24(23). Pronotum with a small medial piceous spot on anterior margin (Fig. 60A); antenna entirely yellow; male protarsal claws subequal . . . . 12. *N. dimidiatus* (Gemminger and Harold)

24. Pronotum broadly piceous along anteromedial emargination (Fig. 61A); antenna with at least antennomere 11 infuscate; male anterior protarsal claw shorter and more arcuate than posterior . . . . .13. *N. superioris* (Balfour-Browne)

1. *Neoporus mellitus* (LeConte 1855)

Fig. 51A – C

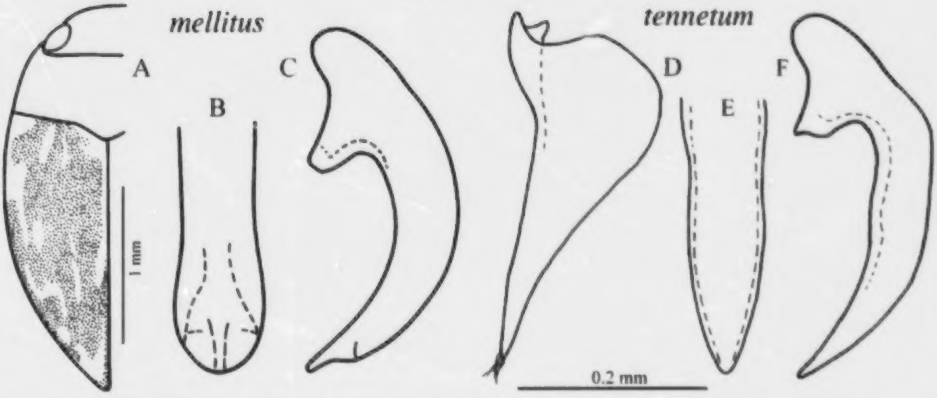


Fig. 51. *Neoporus*. A – C *N. mellitus*. A - body oultine, dorsal. B - aedeagus, dorsal. C - aedeagus, lateral. D – F - *N. tennetum*. D - paramere. E - aedeagus, dorsal. F - aedeagus, lateral.

Hydroporus mellitus LeConte 1855: 293, 299. Type locality - Vermont.

Selected References. Wolfe 1984: 410 – 417, Hilsenhoff 1995: 19.

Description. Length = 2.3 to 2.6 mm; width = 1.2 to 1.5 mm; length: width = 1.74 to 1.87. Small, body (Fig. 51A) short and broad, broadly rounded anteriorly, acutely pointed posteriorly.

Entire body reddish yellow except elytra which possess diffuse brownish maculations as follows: sutural margin, four longitudinal discal vittae, and a subhumeral, a mediolateral and a postmedial spot, these dark markings may be expanded and confluent on some specimens.

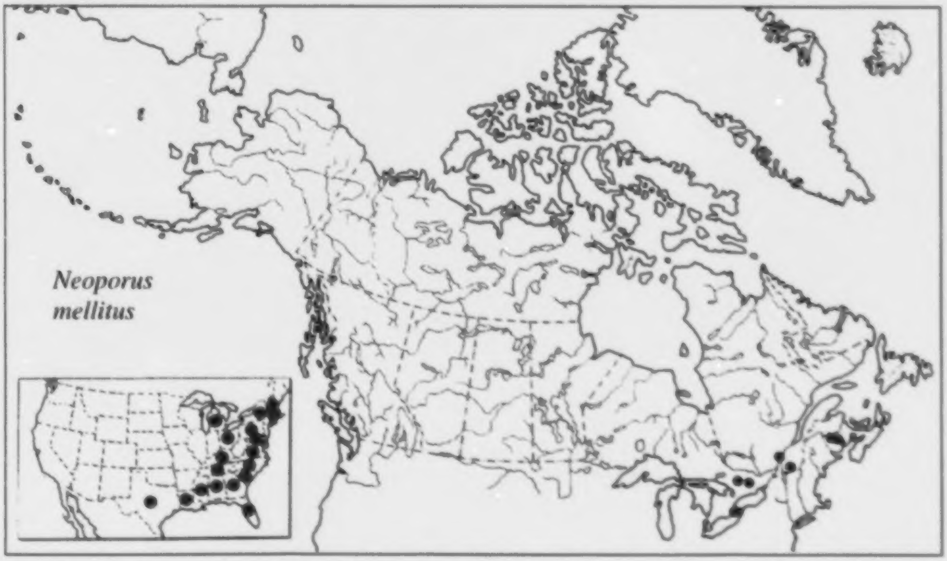
Head finely but conspicuously punctate. Pronotum with larger punctures, sparser and shallower medially, coarser and denser laterally. Elytron with punctures distinct and separated by about twice their own diameters, punctures of most specimens arranged in vague transverse series; setae fine, slightly longer than distance between punctures. Metasternum and metacoxa with larger, well separated punctures; epipleuron indistinctly punctate. Surface shiny but with lightly impressed reticulate sculpture.

Clypeus not thickened anteriorly. Pronotum with lateral bead very narrow and not conspicuously widened towards anterior angle. Elytron with lateral margin slightly arcuate and ascendant. Prosternum in lateral aspect smoothly descendant to prosternal process, prosternal prominence and file obsolete; prosternal process with apex bluntly pointed, metasternum with a small, deep impression for its reception; metasternum sulcate medially.

Male with protarsomeres 1 to 3 very slightly dilated (male recognized chiefly by presence of scales on the ventral surface of tarsomeres 1 (two pairs) and 2 (one pair)); protarsal claws not modified. Aedeagus (Fig. 51B, C) very short and broad, apex broadly rounded to subtruncate in dorsal aspect.

Ecology. This lotic species occurs on firm clay or clay-sand substrates along quiet margins of small streams. Specimens are usually found among mats of protruding roots, in trailing vegetation or under undercut banks. Teneral specimens have been collected in May and June in the southeastern United States.

Distribution. Map 70. The range extends from New Brunswick to Ontario and south to Florida and Texas.



Map 70. *Neoporus mellitus* (LeConte). Canadian and Alaskan collection localities and United States state records.

2. *Neoporus tennetum* (Wolfe 1984)

Fig. 51D – F

Hydroporus tennetum Wolfe 1984: 420 – 424. Type locality - Hawkins Co., Tennessee.

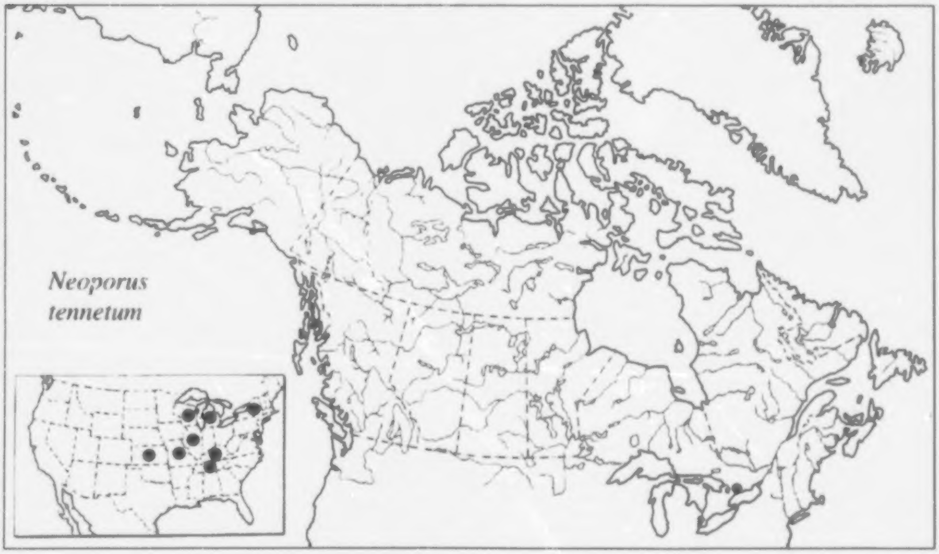
Selected References. Wolfe 1984: 410 – 417; Hilsenhoff 1995: 20.

Description. Length = 2.5 to 2.7 mm; width = 1.3 to 1.4 mm; length: width = 1.89 to 1.96. Small species, similar to *N. mellitus* but slightly longer and body outline slenderer.

Entire body reddish yellow to pale brown except elytra with brownish maculations as follows: sutural margin and four or five longitudinal vittae, vittae 1 to 3 more or less complete, outer vittae broken into a medial and a subapical section, these sections and adjacent portions of more medial vittae variously widened and contiguous so as to form indistinct to relatively well developed transverse darkened areas near middle and subapically; shoulder area entirely pale and without a subhumeral spot.

Pattern of punctation similar to that of *N. mellitus* except punctures smaller and shallower medially on pronotum and on disc of elytron. Metasternum and metacoxa with larger, well separated punctures; epipleuron indistinctly punctate. Surface shiny but with lightly impressed reticulate sculpture.

Clypeus not thickened anteriorly. Pronotum with lateral bead very narrow and not conspicuously widened towards anterior angle. Elytron with lateral margin slightly arcuate and ascendant. Prosternum in lateral aspect smoothly descendant to prosternal process, prosternal prominence and file obsolete; prosternal process with apex bluntly pointed, metasternum with a small, deep impression for its reception; metasternum sulcate medially.



Map 71. *Neoporus tennetum* (Wolfe). Canadian and Alaskan collection localities and United States state records.

Male with protarsomeres 1 to 3 very slightly dilated (male recognized chiefly by presence of scales on the ventral surface of tarsomeres 1 (two pairs) and 2 (one pair)); protarsal claws not modified. Aedeagus (Fig. 51E, F) in dorsal aspect evenly narrowing in apical half and apex sharply pointed.

Ecology. Wolfe (1984) stated the species occurs in small to medium sized creeks in which the beetles tend to occur among roots of overhanging, grassy banks as well as in silty backwater areas. Teneral specimens have been collected in June in the southeastern United States.

Distribution. Map 71. The range extends from New York and southern Ontario west to Wisconsin and eastern Kansas and south to Tennessee. For the most part, the range of *N. tennetum* lies to the north and west of that of *N. mellitus*. However, in Tennessee, where there is a broad overlap in distributions, *N. tennetum* and *N. mellitus* have never been collected syntopicaly (G. Wolfe, pers. com.).

3. *Neoporus blanchardi* (Sherman 1913)

Fig. 52

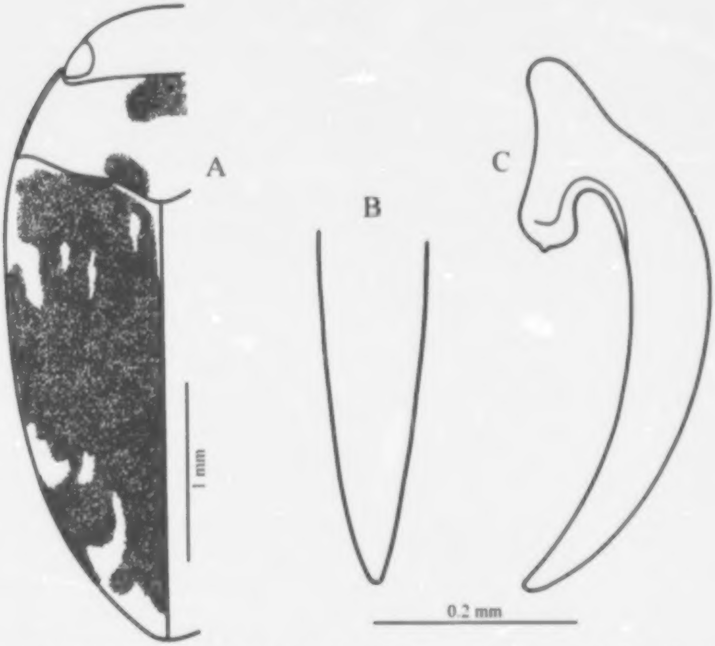


Fig. 52. *Neoporus blanchardi* . A - left body outline, dorsal. B - aedeagus, dorsal. C - aedeagus, lateral.

Hydroporus vitiosus; Sharp 1882*a*: 443 [not LeConte 1855].

Hydroporus blanchardi Sherman 1913: 52. New name for *H. vitiosus* Sharp.

Selected References. Fall 1923: 24 – 25; Young 1954: 87; Young 1967b: 63 – 65.

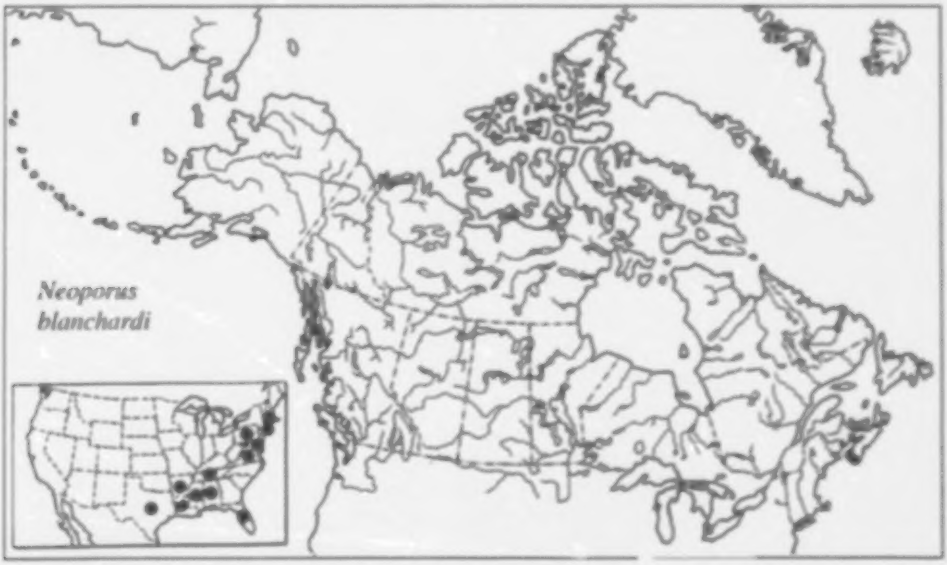
Description. Length = 3.2 to 3.7 mm; width = 1.7 to 1.9 mm; length: width = 1.96. Body (Fig. 52A) elongate oval, depressed, most specimens with maximum width anterad of middle and near base of elytra, more anteriorly than normal within the genus.

Head reddish yellow; palpi pale; antenna yellow with at least apical flagellomere infuscate. Pronotum reddish yellow with an ill-defined brownish spot at middle of anterior margin, and posterior margin nebulously darkened medially. Elytron with disc largely brownish, lateral margins yellow with expanded pale spots at shoulder, subhumerally, postmedially and apically; most specimens with one or two isolated yellow spots mesad to subhumeral spot and a larger subbasal spot near sutural margin; also many specimens with small pale discal spots postmedially. Ventral surface reddish yellow with lateral portions of sterna 2 and 3 vaguely infuscate.

Dorsal surface with punctation relatively fine and sparse; surface reticulate in both sexes. Pronotum relatively sparsely punctate medially, more densely and coarsely punctate towards margins. Elytron with punctation coarsest basomedially, finer and sparser posteriorly and apically; setae fine, subequal in length to distance between punctures. Metasternal wing with coarse punctures; metacoxa with punctures smaller, sparse and very shallow; sterna 1 and 2 even more sparsely and finely punctate; epipleuron with punctures small and sparse but evident.

Clypeus with anterior border not thickened. Pronotal bead moderately broad, widened and flattened anteriorly. Elytron with lateral margin straight in lateral aspect, epipleuron almost horizontal and largely hidden by lateral margin of elytron. Prosternum with file obsolete but a low angular prominence present. Metasternum impressed medially along anterior portion of midline.

Male protarsus narrowly dilated; protarsal claws not modified. Aedeagus (Fig. 52B, C) simple, bluntly pointed apically in lateral aspect.



Map 72. *Neoporus blanchardi* (Sherman). Canadian and Alaskan collection localities and United States state records.

Comments. Sharp (1882*a*: 443) described a single male specimen from North America as *H. vitiosus* LeConte. Sherman (1913) recognized that Sharp had a different species than that described by LeConte and proposed *H. blanchardi* as the name of Sharp's species. Therefore Sharp's single specimen, in BMNH, is the type specimen. The species *N. helocrinus* (Young 1967*b)*, *N. rheocrinus* (Young 1967*b)*, *N. tigrinus* (Fall 1923) and *N. psammodytes* (Young 1978) form a complex with *N. blanchardi*. This complex requires considerable study to resolve the species limits.

Ecology. These beetles occur in small streams and springs, generally among emergent plants or mosses, and in depositional areas with organic silt substrates. Young (1967*b)* observed the species was usually in shaded sites.

Distribution. Map 72. The range extends from Nova Scotia to Florida and west to Arkansas and Texas.

4. *Neoporus vitiosus* (LeConte 1855)

Fig. 53

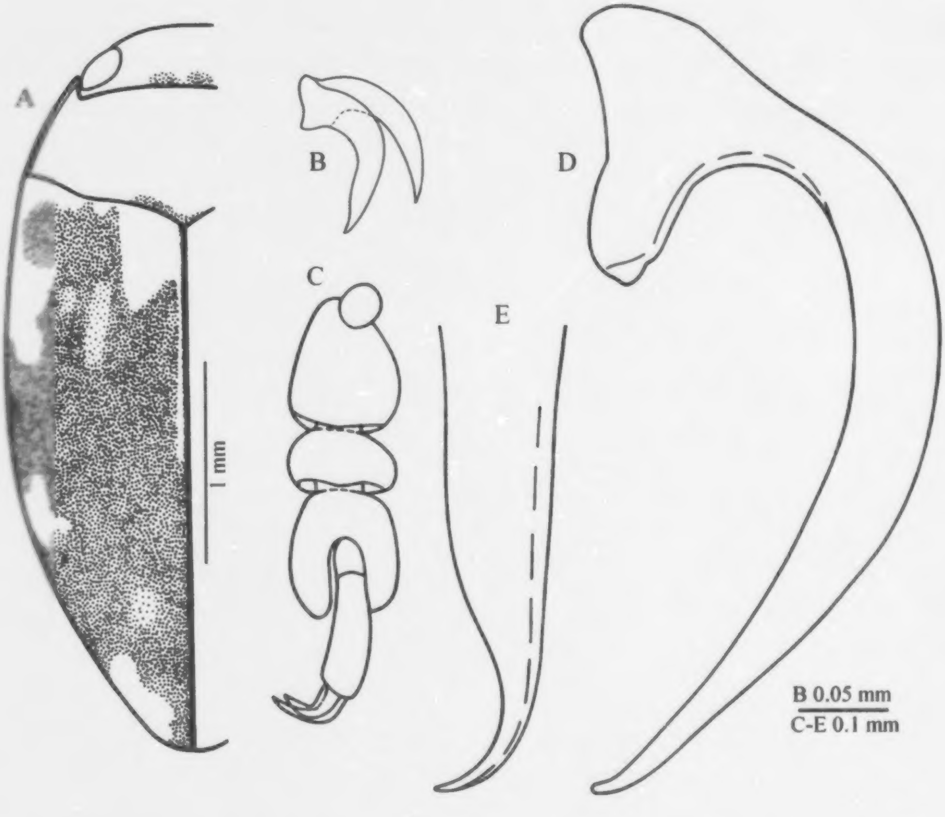


Fig. 53. *Neoporus vitiosus* (LeConte). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus vitiosus LeConte 1855: 297. Type locality - Illinois.

Selected Reference. Fall 1923: 22 – 23.

Description. Length = 3.4 to 3.8 mm; width = 1.7 to 1.9 mm; length: width = 1.92 to 2.00. A moderately elongate-oval species (Fig. 53A)

Head and pronotum reddish brown, either without definite maculation or hind margin of head narrowly darkened on some specimens; palpi yellow; antenna yellow with at least apical antennomere infuscate, most specimens with antenna infuscate from about middle. Elytron brown to brownish piceous with pale, little contrasting spots as follows: shoulder; lateral margin which is expanded subbasally, postmedially and subapically; a subsutural basal spot, and on some specimens one or two small spots laterad to it. Epipleuron and lateral portions of ventral portions of prothorax pale, remainder of ventral surface rufopiceous to black with metathorax darker than abdomen on most specimens.

Dorsal surface with punctation fine, more or less even and moderately dense; finely pubescent. Metasternal wings coarsely punctate, metacoxa and sterna 1 and 2 finely and densely punctate; epipleuron even more finely punctate; abdominal sterna 3 to 6 with dense, fine punctation. Male with microreticulation lightly impressed, surface shiny; female with microreticulation dense, surface matte.

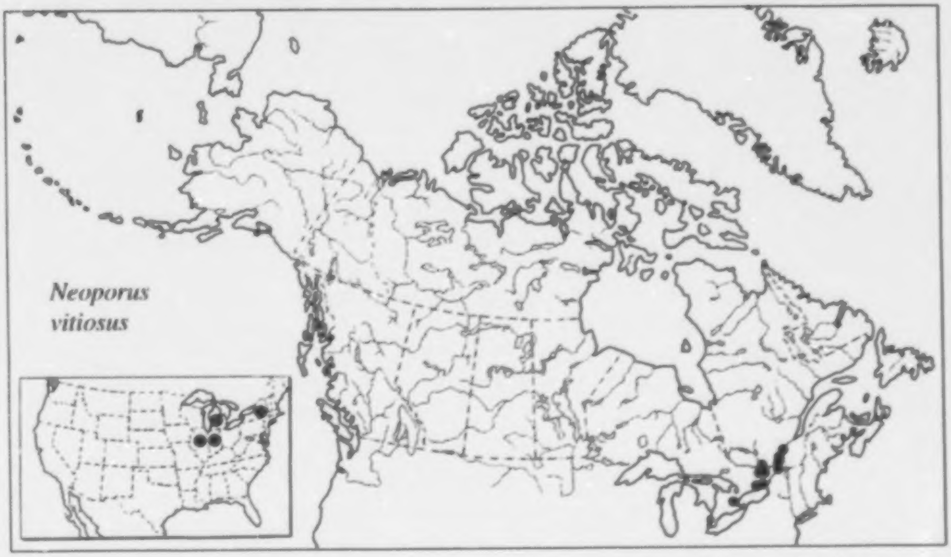
Clypeus not thickened. Pronotal bead narrow basally, widening to anterior angle, not or only faintly flattened dorsally. Lateral margin of elytron slightly sinuate behind shoulder in lateral aspect, epipleuron not visible to shoulder. Prosternum with declivity shallow, file obsolete, prominence evident. Metasternum not sulcate medially, or with a short depression behind level of mesocoxae, metasternum laterad to median line more or less evenly rounded and not ridged or with a pronounced longitudinal convexity.

Male protarsus (Fig. 53C) moderately dilated; protarsal claws (Fig. 53B) subequal, anterior claw slightly broader and more arcuate than posterior. Aedeagus (Fig. 53D, E) elongate and slender in lateral aspect, apex twisted to left in dorsal aspect.

Comments. Fall (1923) compared this species with *Hydroporus* (= *Heterosternuta*) *oppositus*, with which it is definitely not related. Wolfe (1984) included *vitiosus* in *Neoporus*. It resembles species of *Neoporus* in that the elytra are patterned (although rather vaguely so), the metacoxal processes are conjointly medially angulate, and it occurs in lotic habitats. On the other hand, several species of *Hydroporus*, especially those occurring in lotic habitats or on mineral substrates, have similarly patterned elytra, and some have distinctly angulate metacoxal processes. The finer and denser punctation, dark ventral surface, reduced metasternal sulcus, and peculiarly twisted aedeagus are atypical for *Neoporus*.

Ecology. Specimens occur among gravel and rocks along quiet margins of small to medium sized streams.

Distribution. Map 73. The range extends from southern Quebec and Ontario to Illinois.


Neoporus
vitiosus

Map 73. *Neoporus vitiosus* (LeConte). Canadian and Alaskan collection localities and United States state records.

5. *Neoporus sulcipennis* (Fall 1917)

Fig. 54

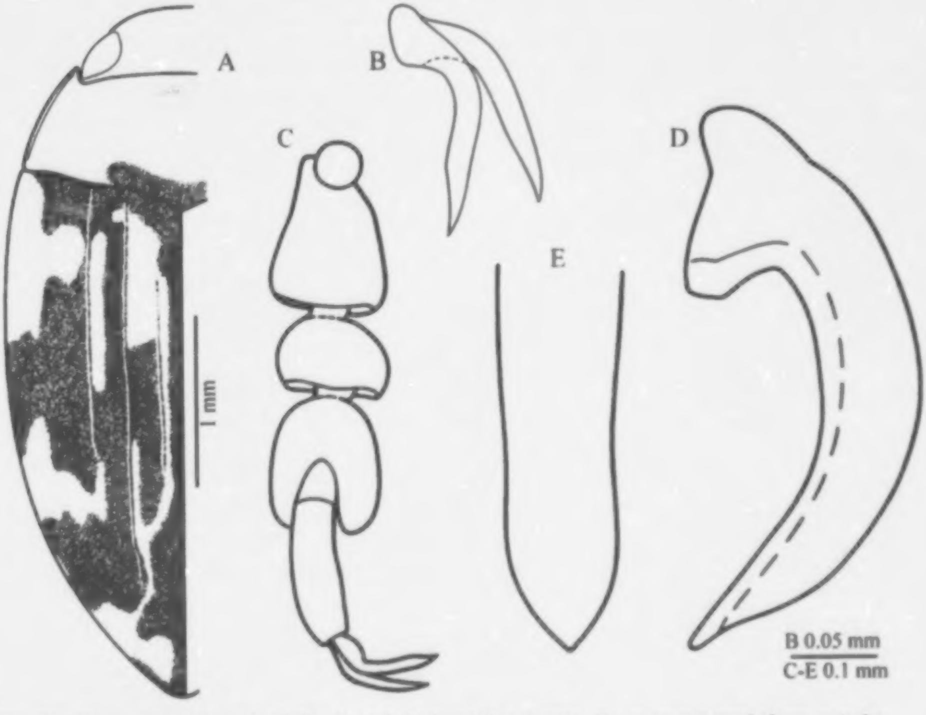

A
B
C
D
E
1 mm
B 0.05 mm
C-E 0.1 mm

Fig. 54. *Neoporus sulcipennis (Fall)*. A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus sulcipennis Fall 1917: 175 – 176. Type locality - not restricted.

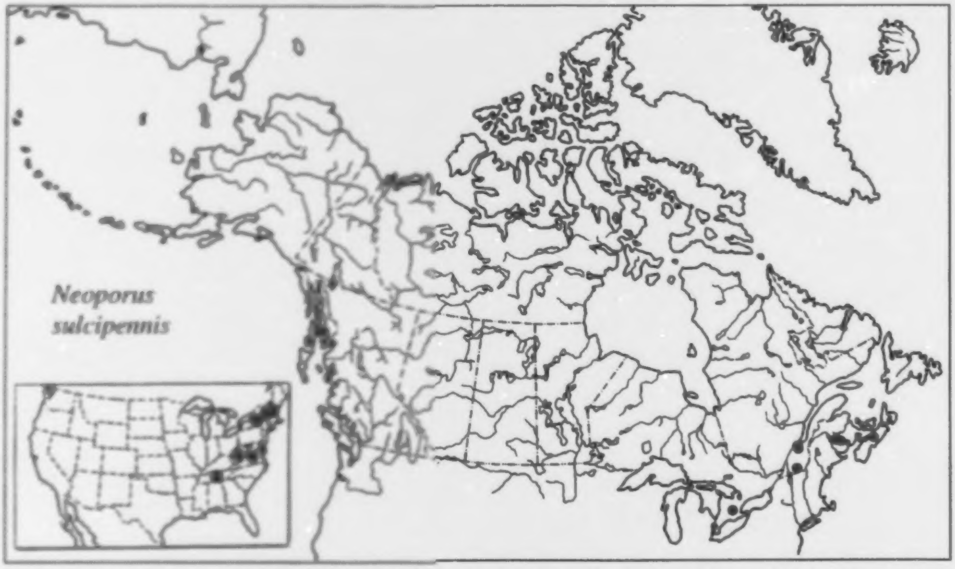
Selected Reference. Fall 1923: 26.

Description. Length = 3.7 to 4.0 mm; width = 1.9 to 2.0 mm; length: width = 1.87 to 1.98. A relatively broadly oval, medium sized species (Fig. 54A).

Head yellow to reddish yellow; antenna and palpi without apical infuscation. Pronotum reddish yellow, basal margin narrowly piceous on each side of middle, and some specimens with a small medial piceous spot on anterior margin. Elytron yellow with brown or piceous maculations as follows: along basal and sutural margins and with transverse vittae medially and subapically, these transverse fasciae may be longitudinally extended along convexities so that basal, medial and subapical fasciae are variously connected producing various sized pale spots on disc. Ventral surface and legs yellowish.

Dorsal surface reticulate but male with lines shallow and surface rather shiny. Punctation fine, body finely pubescent. Metasternal wings and metacoxal plates with very coarse punctures, those on metasternum crowded, more widely spaced on metacoxa; sterna 1 and 2 with smaller but still coarse punctures; epipleuron obscurely punctate.

Clypeus not thickened. Pronotum with lateral bead narrow, of more or less uniform width except at front angle where it is slightly broadened on most specimens. Elytron with 3 or 4 longitudinal sulci, subsutural and adjacent sulci extending through basal two-thirds to three-quarters of disc, sulcus 2 bounded by a rather abrupt lateral convexity; sulcus 3 faintly impressed on basal half; sulcus 4 faint or absent, confined to base; lateral margin more or less straight in lateral aspect, epipleuron disappearing well posterad to shoulder. Prosternal file and prominence faint or obsolete. Metasternum broadly sulcate medially, metasternum strongly convex on each side of sulcus. Metacoxal lines less convergent than in *N. spurius*.



Map 74. *Neoporus sulcipennis* (Fall). Canadian and Alaskan collection localities and United States state records.

Male protarsus (Fig. 54C) broadened; claws (Fig. 54B) subequal, anterior claw more arcuate basally and strongly sinuate ventrally. Aedeagus (Fig. 54D, E) broad in dorsal aspect, abruptly narrowed to apex.

Ecology. This species occurs in small to medium sized warm, clear streams. Specimens occur in depositional areas along the stream margins.

Distribution. Map 74. The range extends from New Brunswick and Ontario (Bruce Co.), south along the Appalachian Mountains to Virginia and Tennessee.

6. *Neoporus spurius* (LeConte 1855)

Fig. 55

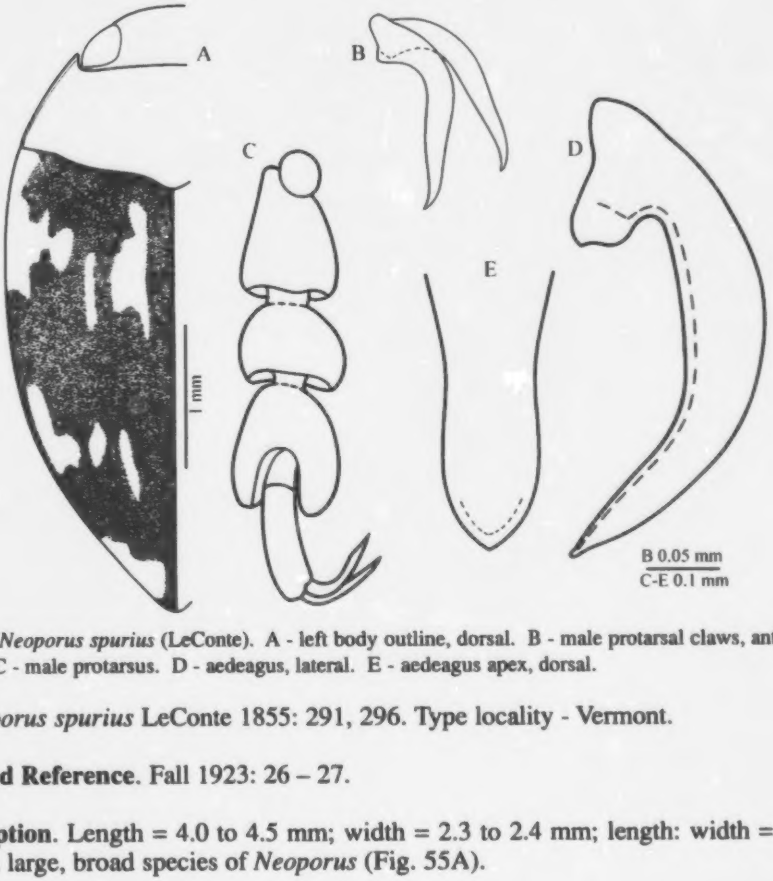


Fig. 55. *Neoporus spurius* (LeConte). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus spurius LeConte 1855: 291, 296. Type locality - Vermont.

Selected Reference. Fall 1923: 26 – 27.

Description. Length = 4.0 to 4.5 mm; width = 2.3 to 2.4 mm; length: width = 1.67 to 1.84. A large, broad species of *Neoporus* (Fig. 55A).

Head reddish yellow; antenna and palpi without apical infuscation. Pronotum reddish yellow, anterior and basal margins not infuscate. Elytron yellow with sharply contrasting black maculations as follows: sutural margin, basal margin (but not reaching humeral angle and expanded about middle of base), a medial transverse vitta, and a postmedial transverse vitta, transverse vittae contacting dark sutural band or not, narrowly separated from lateral margin, boundaries of vittae longitudinally undulated and variously longitudinally confluent with basal band or each other to produce isolated pale discal spots. Ventral surface reddish yellow.

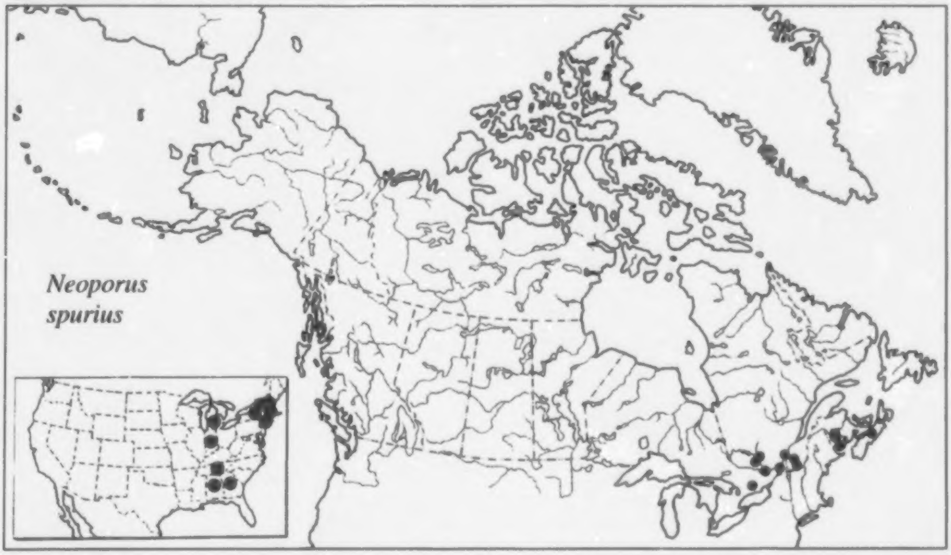
Dorsal surface uniformly and rather densely covered with moderate punctures; pubescence very fine and short. Metasternal wing very coarsely punctate, punctures of metacoxal plate slightly smaller but still very coarse; sterna 1 and 2 with punctures coarse but smaller than those of metacoxa; epipleuron obsoletely punctate.

Clypeus not margined. Pronotum with lateral bead well developed, widened anteriorly on most specimens and dorsally flattened. Elytron faintly sulcate, with a sutural sulcus traceable to apex, and a discal sulcus on basal one-third to one-half separated from mesal serial punctures by a narrow convex area; serial punctures impressed and sulcate or not; lateral margin straight or slightly ascendant in lateral aspect, epipleuron disappearing well posterad of shoulder. Prosternal file and prominence obsolete. Metasternum sulcate medially, sides of metasternum strongly convex laterad of sulcus. Metacoxal lines more diverging than in *N. sulcipennis*.

Male protarsus (Fig. 55C) evidently dilated; protarsal claws (Fig. 55B) subequal, anterior claw more arcuate basally and sinuate ventrally. Aedeagus (Fig. 55D, E) short and blunt in dorsal aspect.

Ecology. This species occurs in small to medium sized clear, warm streams. Specimens are found in depositional areas such as at the margins of quiet pools, backwaters, undercut banks and isolated marginal pools.

Distribution. Map 75. The range extends from New Brunswick to Ontario and south to northern Georgia and Alabama.



Map 75. *Neoporus spurius* (LeConte). Canadian and Alaskan collection localities and United States state records.

7. *Neoporus dilatatus* (Fall 1917)

Hydroporus dilatatus Fall 1917: 174 – 175. Type locality - Bladensburg, Maryland.

Selected References. Fall 1923: 27 – 28; Young 1954: 88.

Description. Length = 3.8 to 4.4 mm; width = 2.1 to 2.4; length: width = 1.80 to 1.95.

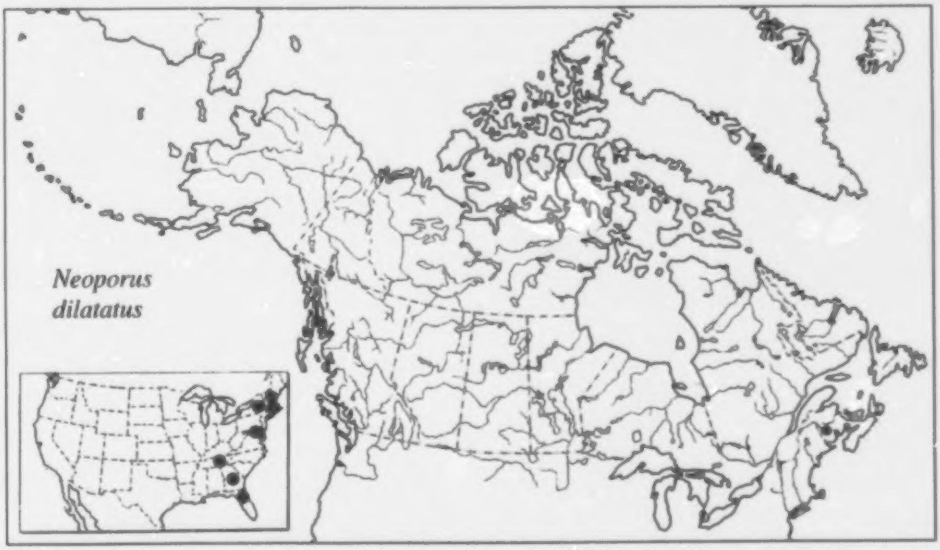
Head yellow to reddish-yellow; antennae and palpi yellow, without infuscation. Pronotum yellow medially, anterior margin with a piceous spot along medial emargination, hind margin with a more or less bilobed spot medially. Elytron with a brightly contrasting fasciate pattern of *undulatus* type, medial transverse dark fascia completely separating pale anterior and posterior pale discal areas. Ventral surface and legs pale reddish-yellow.

Head finely punctate. Pronotum with more or less even moderate sized punctures. Elytron with regular moderate sized punctures, setae pale and thin, separated by a distance about equal to their length; epipleuron with punctures shallow and inconspicuous, widely spaced. Metasternal wing coarsely punctate laterally; metacoxal plate with smaller but coarse punctures, evenly distributed and separated by about their own diameters.

Clypeus slightly thickened. Pronotal bead of moderate width, narrow on hind angle, slightly widened anteriorly then more or less of uniform width, flattened dorsally. Elytron without longitudinal sulci; lateral margin in lateral aspect faintly ascendant to humeral angle; epipleuron hidden shortly behind shoulder, otherwise broadly visible in lateral view. Prosternum with prominence low, broadly angulate. Metasternum medially with medial line shallowly and narrowly impressed.

Male protarsi relatively narrow, protarsomere 3 width about two-thirds of length, subequal in width to protarsomeres 1 and 2; protarsal claws slender, anterior slightly shorter and broader and faintly sinuate ventrally.

Ecology. Fall (1923) and Young (1954) stated the species is found in clear running water. This corresponds to the habitat in which Canadian specimens were collected - a small (second or third order), clear stream running over gravel. The stream was exposed and sun-warmed.



Map 76. *Neoporus dilatatus* (Fall). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 76. The range extends along the Atlantic coast from New Brunswick to Florida. The single Canadian locality is Keswick River at Zealand, New Brunswick (2, MUN).

8. *Neoporus clypealis* (Sharp 1882)

Fig. 56

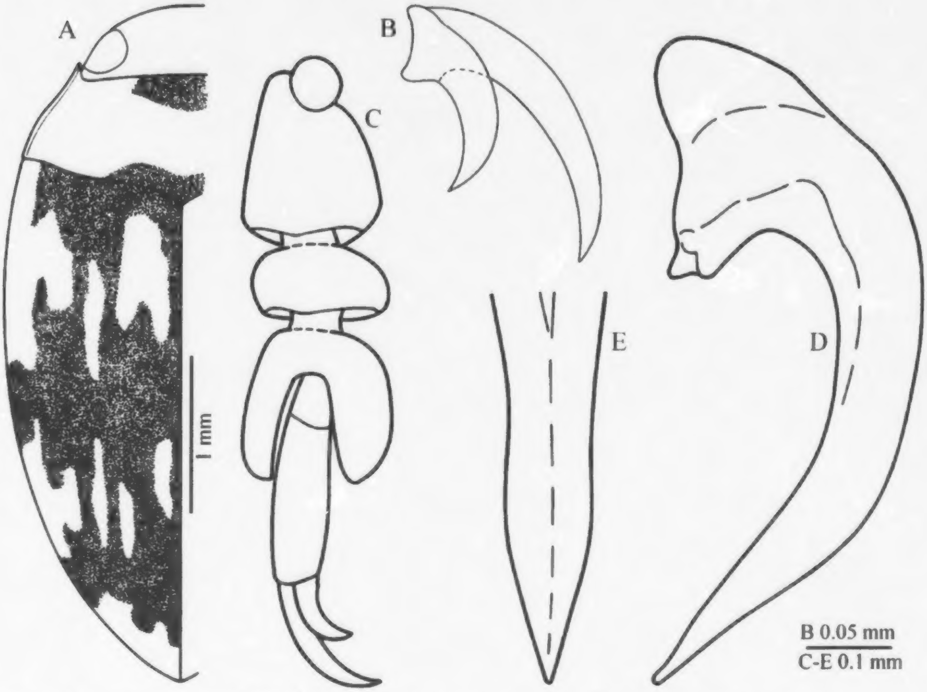


Fig. 56. *Neoporus clypealis* (Sharp). A - female, left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus clypealis Sharp 1882*a*: 441. Type locality - Massachusetts.

Selected References. Fall 1923: 40; Young 1954: 95; Hilsenhoff 1995: 18.

Description. Length = 3.9 to 4.5 mm; width = 2.1 to 2.5 mm; length: width = 1.81 - 1.92. Similar to *N. undulatus* but on average a little larger and more robust (Fig. 56A).

Color pattern similar to *N. undulatus*. Head reddish yellow; palpi entirely yellow; antenna yellow except at least apical antennomere infuscate. Pronotum reddish yellow with a piceous spot medially on both anterior and basal margins, these spots may be enlarged and longitudinally confluent on some specimens. Elytron with transverse pattern of maculation, with pale lateral margin and transverse bands subbasally, postmedially and subapically (on some specimens dark areas may be expanded and transverse pale bands reduced to isolated spots). Ventral surface and legs reddish yellow.

Dorsal surface evidently punctate and setose. Reticulate sculpture present; male shiny; female with lines of reticulation dense and surface matte. Metasternal wing and metacoxal plate densely, coarsely punctate; sterna 1 and 2 with punctures smaller; epipleuron with punctures evident but small and widely separated.

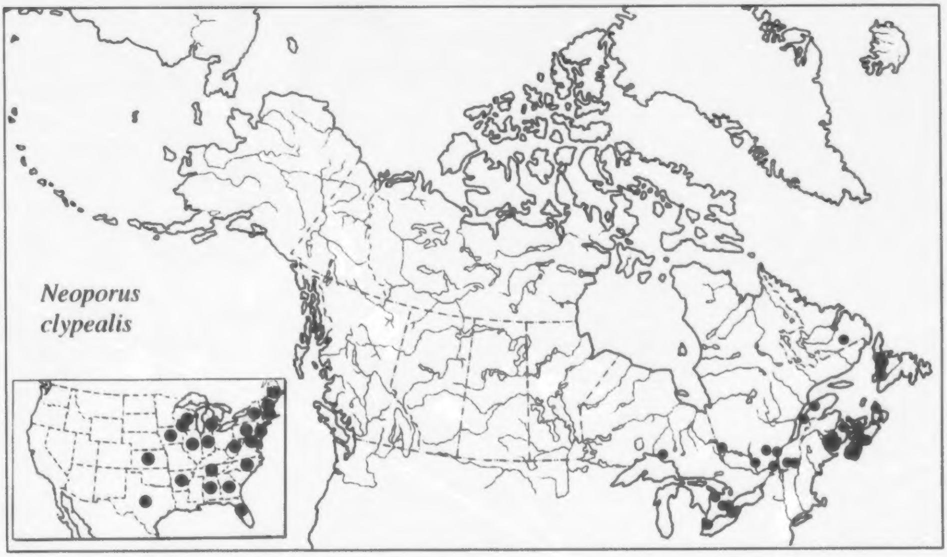
Clypeus thickened, more or less distinctly limited from frons by a low ridge. Pronotum with lateral bead moderately broad on male, of more or less uniform width throughout or slightly widened anteriorly; female (Fig. 56A) with lateral bead slightly narrower, strongly impressed or narrowed laterally near front angle, anterolateral margin distinctly sinuate. Prosternal prominence strongly developed. Elytron straight laterally or very slightly arcuate. Metasternum sulcate medially.

Male with protarsomere 3 deeply bilobed (Fig. 56C); anterior protarsal claw (Fig. 56B) about half length of posterior claw, broader and more arcuate; aedeagus (Fig. 56D, E) narrow, sharply pointed apically.

Comments. The most serious taxonomic problems with *N. clypealis* centres on the relationships between it and *N. gaudens* (Fall 1923) and *N. mixtus* (LeConte 1855). *Neoporus gaudens* was described from Georgia. *Neoporus mixtus* was described from Nebraska and Fall (1923) gave additional records from Iowa and Kansas. The species are separated on subtle differences in the length and degree of sinuation of the male anterior protarsal claw and it is likely they are conspecific. If these taxa are shown to be conspecific, *N. mixtus* is the oldest available name.

Ecology. This species occurs among emergent vegetation such as sedges, along the margins of slow, marshy streams, beaver ponds and small lakes. Specimens are generally found where there is some water movement or at least flushing, and are usually on mineral substrates.

Distribution. Map 77. The range extends from Newfoundland and Labrador to Florida and east to Ontario, Kansas and Texas.



Map 77. *Neoporus clypealis* (Sharp). Canadian and Alaskan collection localities and United States state records.

9. *Neoporus carolinus* (Fall 1917)

Fig. 57

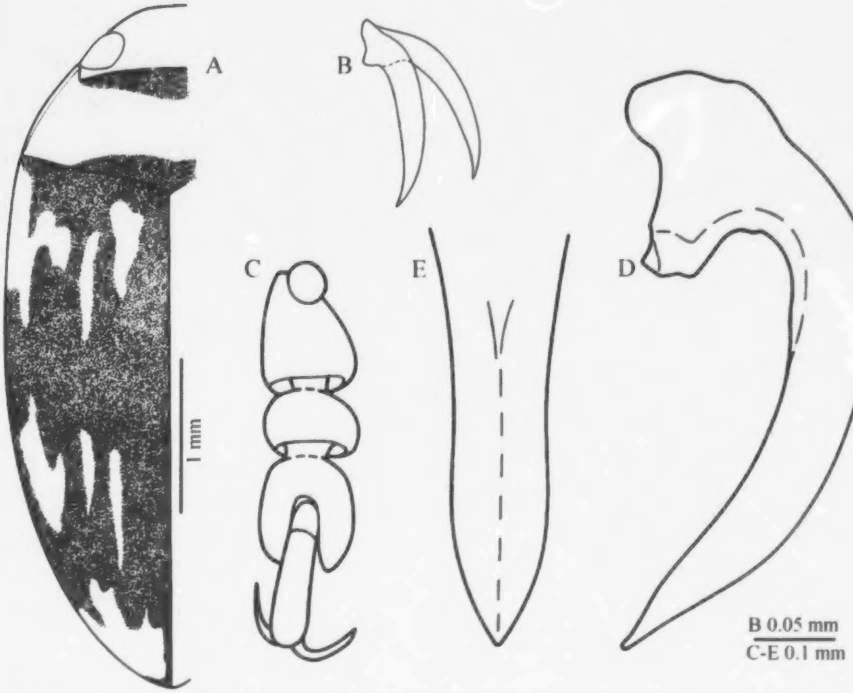


Fig. 57. *Neoporus carolinus* (Fall). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus carolinus Fall 1917: 180. Type locality - Highlands, North Carolina.

Selected References. Fall 1923: 38; Young 1954: 94.

Description. Length = 3.3 to 4.3 mm; width = 1.9 to 2.2 mm; length: width = 1.86 to 2.02. Similar to *N. undulatus* but specimens slightly smaller and narrower on average (Fig. 57A).

Head reddish yellow; palpi and antenna yellow except antenna of most specimens with apical antennomere infuscate. Pronotum reddish yellow with a medial piceous spot along both anterior and basal margins, spots not contiguous medially. Elytron with maculation various; basically of transverse pattern of *N. undulatus* but many specimens with pale markings reduced and disc almost completely piceous.

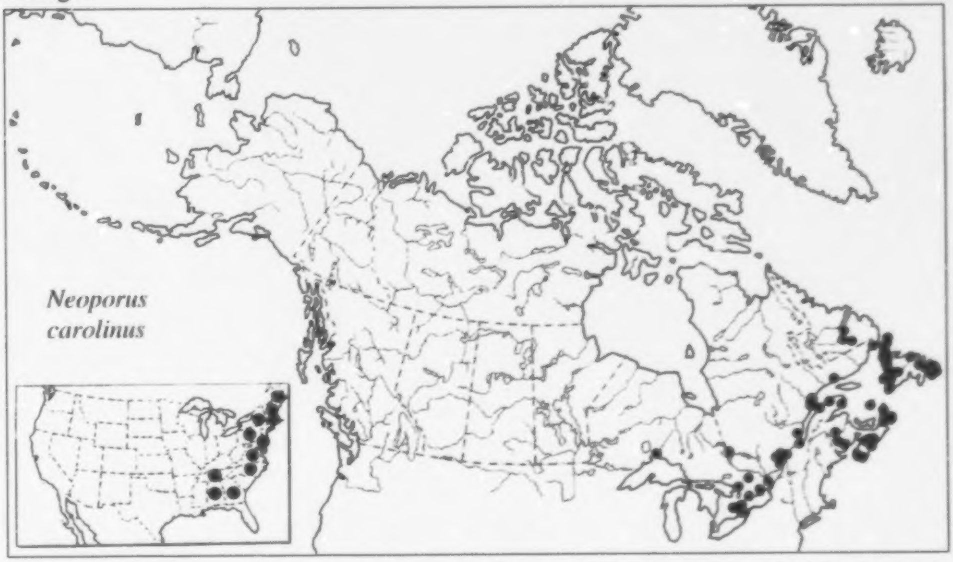
Punctation differing from that of *N. undulatus* as follows: elytron with punctures sparser, setae sparser and less conspicuous; metacoxal plate more coarsely punctate and punctures on average more widely separated, those medially distinctly larger than those of sterna 1 and 2; epipleuron with punctation very fine and sparse, inconspicuous. Male with dorsal surface shiny, reticulation lightly impressed; female similar to male or with dense microreticulation and surface matte.

Clypeus with anterior margin slightly thickened but not evidently rimmed. Pronotum with lateral bead broadened anteriorly, bead flattened or longitudinally grooved dorsally. Elytron with lateral margin straight or very faintly arcuate basally; epipleuron more impressed than that of *N. undulatus*, less visible in lateral aspect. Prosternal file obsolete, prominence evident, angulate.

Male protarsus (Fig. 57C) a little narrower than that of *N. undulatus*, protarsomere 3 more quadrate; anterior protarsal claw (Fig. 57B) not so broad or so strongly sinuate ventrally. Aedeagus (Fig. 57D, E) slender, more pointed apically.

Ecology. This species occurs in slow, boggy streams and ditches. Specimens are often found in brown water and in streams draining peatlands. The third instar larva was described by Alarie (1991).

Distribution. Map 78. The range extends from Newfoundland to Ontario and south to Georgia.



Map 78. *Neoporus carolinus* (Fall). Canadian and Alaskan collection localities and United States state records.

10. *Neoporus undulatus* (Say 1823)

Fig. 58

Hydroporus undulatus Say 1823: 154. Type locality - not stated, probably Pennsylvania (Fall 1923: 34).

Hydroporus fasciatus Harris 1828*b*: 164. Type locality - not stated by author. Ipswich, Massachusetts (Fall 1923: 34).

Hydroporus pubipennis Aubé 1838*b*: 480. Type locality - North America.

Hydroporus velutinus Aubé 1838*b*: 481. Type locality - North America.

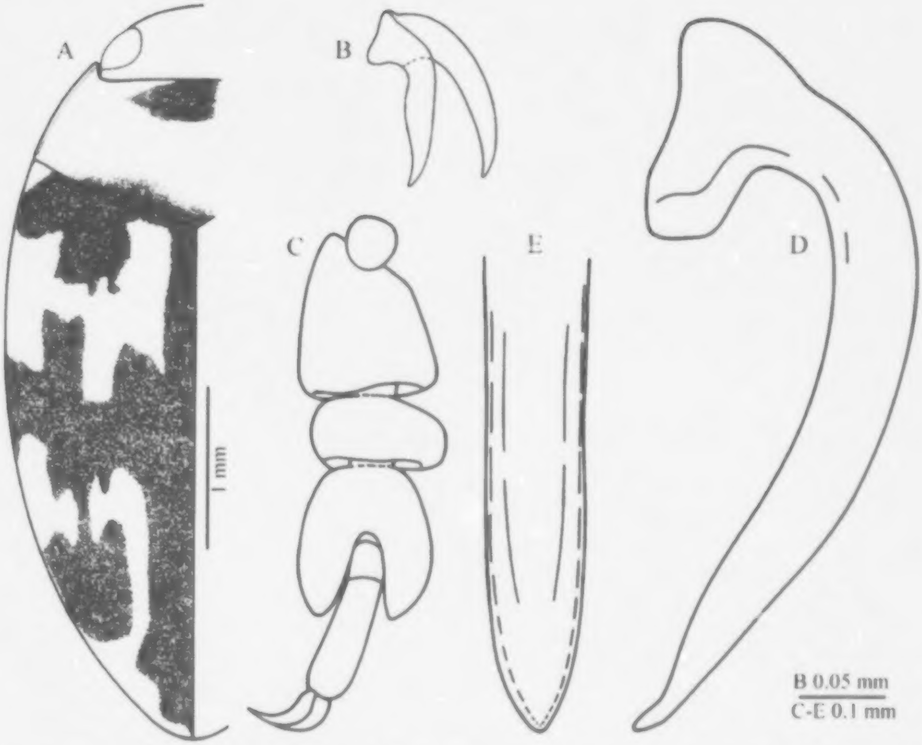


Fig. 58. *Neoporus undulatus* (Say). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus punctatissimus Aubé 1838*b*: 484. Type locality - North America.

Hydroporus consimilis LeConte 1850: 214. Type locality - not given, assumed to be Lake Superior.

Hydroporus scrutator Sharp 1882*a*: 440. Type locality - Ega?, North America.

Hydroporus anticus Sharp 1882*a*: 441. Type locality - North America, Pennsylvania and Louisiana.

Hydroporus placatus Fall 1917: 177. Type locality - Corvallis, Oregon.

Selected References. Fall 1923: 31 – 35 (*undulatus*), 36 – 38 (*consimilis*); Larson 1975: 286 – 287; Hilsenhoff 1995: 20.

Description. Length = 3.7 to 4.7 mm; width = 2.2 to 2.5 mm; length: width = 1.85 to 1.97. Body outline and color pattern as in Fig. 58A.

Head reddish yellow; antenna with antennomere 11 infuscate and most specimens with at least the terminal 3 or 4 antennomeres infuscate; palpi yellow. Pronotum reddish yellow; anterior margin with a large medial piceous spot; basal margin piceous medially, this piceous area of varied size and on some specimens expanded anteriorly and contacting anterior piceous spot. Elytron yellow with black maculations of varied extent, basically pattern as follows: sutural margin dark; base dark with an expanded spot that does not extend laterally to humeral angle; disc with a medial and a postmedial transverse fascia which are contiguous with dark sutural margin but do not reach lateral margin. Dark pattern may be expanded to cover most of disc and limiting pale area to lateral margin, or basal spot and transverse fasciae may be variously connected longitudinally to produce isolated pale spots of various size on disc; even palest specimens with medial fascia separating pale discal spots of base from those posterad to middle. Ventral surface and legs rufous.

Dorsal surface with reticulate sculpture; this sculpture fine on male and some females so that surface is shiny; many females with lines very dense and surface matte. Dorsal surface moderately punctate and evidently setose. Metasternal wing, metacoxal plate and sterna 1 and 2 with punctures moderately coarse, subequal in size and density; epipleuron with smaller but distinct dense punctation.

Clypeus slightly but evidently thickened. Pronotum with lateral bead of varied width, some specimens with bead narrow and of more or less even width throughout length, others with bead rather broadly expanded and flattened anteriorly. Elytron with lateral margin more or less straight in lateral aspect. Prosternum with prominence large and abrupt, file obsolete. Metasternum narrowly sulcate medially, laterally subangulate.

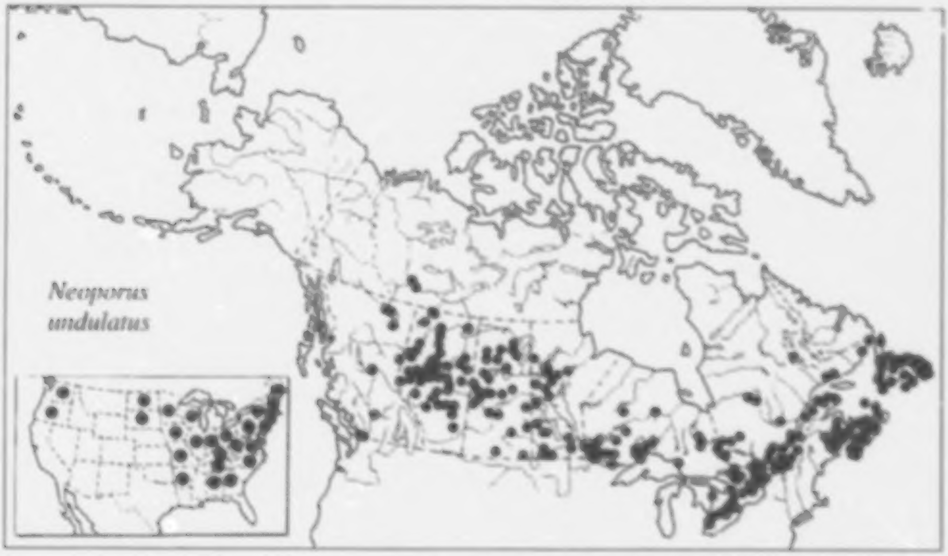
Male pro- and mesotarsi evidently dilated, tarsomeres 3 broadly oval (Fig. 58C); protarsal claws (Fig. 58B) subequal, anterior claw more arcuate basally than posterior, ventrally sinuate. Aedeagus (Fig. 58D, E) elongate, slightly sinuate with apex slightly bent downwards in lateral aspect.

Comments. Virtually all authors who have treated this "species" have commented on the great amount of variation shown among its members. Habitus, density of reticulation, color and width of pronotal bead vary between populations. However there is not a coherent pattern to this variation, either in concordance between characters or geographically, so that it has not been possible to define well delimited subgroups. Male protarsal characters and aedeagus are constant in form throughout the complex supporting the concept of a single polymorphic species. Fall (1923) regarded northern specimens, which includes all specimens from Canada, as belonging to *N. consimilis*. However he recognized that the characters he used to separate *consimilis* from *undulatus*, habitus and width of pronotal bead, were not constant, and subsequent workers have further confirmed the inadequacies of such a division.

Other species that will key to *N. undulatus* are *N. hebes* (Fall 1923), *N. lobatus* (Sharp 1882*a*), *N. lynceus* (Sharp 1882*a*), *N. effeminatus* (Fall 1923), *N. republicanus* (Sharp 1882*a*), *N. uniformis* (Blatchley 1925), *N. baelus* (Young 1984) and *N. asyidtus* (Young 1984). Most of these "species" have distributions centred in the southeastern United States. There are likely a number of species involved in this complex but until the extent and pattern of variation within *N. undulatus* is understood, it will be impossible to define them.

Ecology. The beetles are generally found in permanent habitats where there is some, although often slight, water movement or wave action. For example they occur commonly among emergent vegetation at the margins of beaver ponds, slow marshy streams and small lakes. The larval stages were described by Alarie (1991).

Distribution. Map 79. The aggregate range of the complex extends from Newfoundland to Oregon and from the southern Northwest Territories to Georgia and northern Alabama.



Map 79. *Neoporus undulatus* (Say). Canadian and Alaskan collection localities and United States state records.

11. *Neoporus vittatus* (LeConte 1855)

Fig. 59

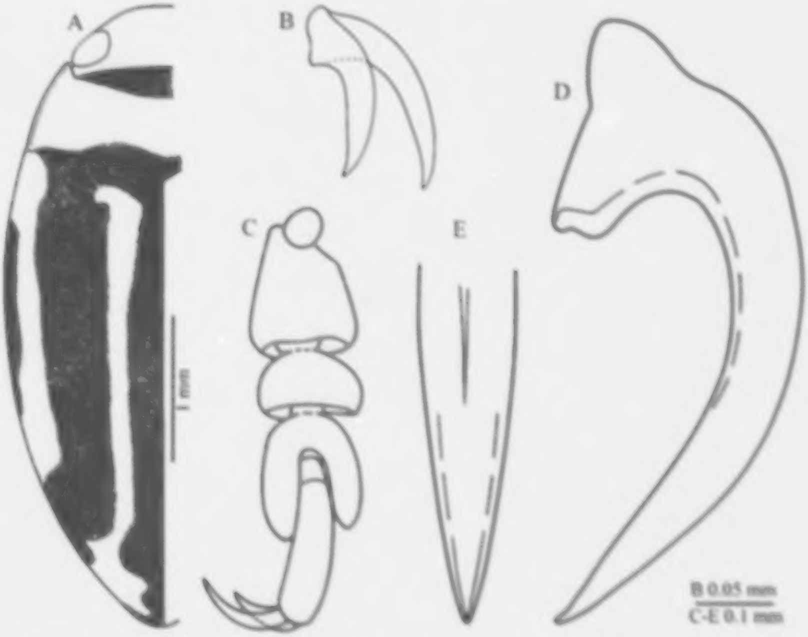


Fig. 59. *Neoporus vittatus* (LeConte). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus vittatus LeConte 1855: 296 – 297. Type locality - Fort Laramie, Wyoming.

Selected References. Larson 1975: 287, Hilsenhoff 1995: 21.

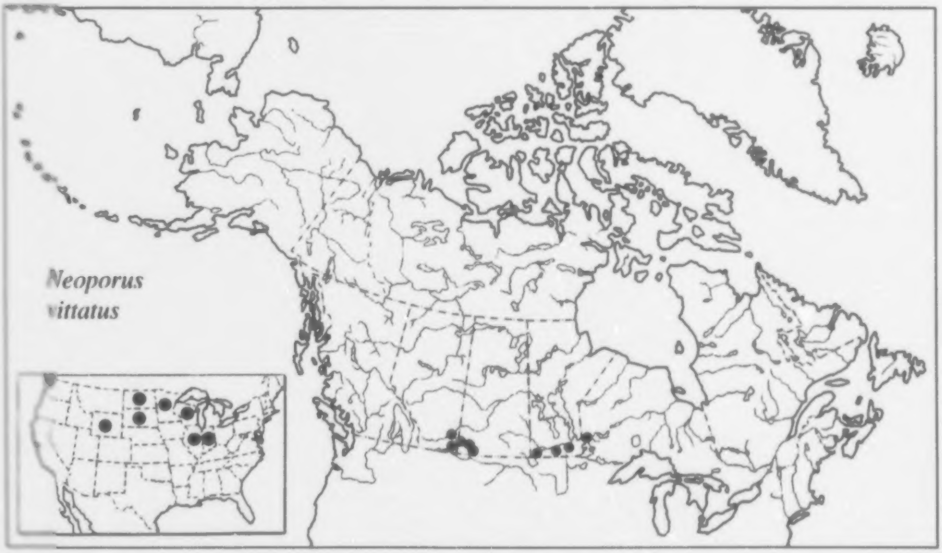
Description. Length = 3.8 to 4.3 mm; width = 2.0 to 2.2 mm; length: width = 1.89 to 2.02. A moderately large, distinctively colored species (Fig. 59A).

Head reddish yellow; palpi yellow; antenna entirely yellow or with apical antennomere lightly infuscate. Pronotum rufous except anterior and posterior margins piceous, more broadly so medially. Elytron rufous, maculate as follows: basal and sutural margins broadly black; disc with a broad medial longitudinal black band and a shorter lateral black spot. Ventral surface rufous with abdominal sternum 2 dark rufous to piceous laterally on many specimens. Legs reddish.

Elytron with punctures small and separated by about their own diameters; with short decumbent golden or pale brown setae; male with disc between punctures shiny with microreticulation finely impressed; female with punctation denser and interspaces dull from denser microsculpture. Metasternum and metacoxa with punctures moderate to small, shallow, approximate on metasternal wings but separated by own diameters or more on coxal plate; epipleuron with punctures small and sparse.

Clypeus not thickened. Pronotum with lateral bead narrow, of more or less even width throughout length or only slightly widened towards front angle. Prosternal prominence low.

Male protarsus (Fig. 59C) of moderate width; anterior protarsal claw (Fig. 59B) shorter than posterior, broadened and evenly arcuate throughout length. Aedeagus (Fig. 59D, E) with apex slightly sinuate in lateral aspect.



Map 80. *Neoporus vittatus* (LeConte). Canadian and Alaskan collection localities and United States state records.

Ecology. In Canada, this species occurs in small, permanent prairie streams. Beetles occur under overhanging banks and among trailing or emergent vegetation along the banks in areas of slow flow.

Distribution. Map 80. The species occurs in the southern prairie provinces and northwestern Ontario (Ingolf) and ranges south to Indiana and Wyoming.

12. *Neoporus dimidiatus* (Gemminger and Harold 1868)

Fig. 60

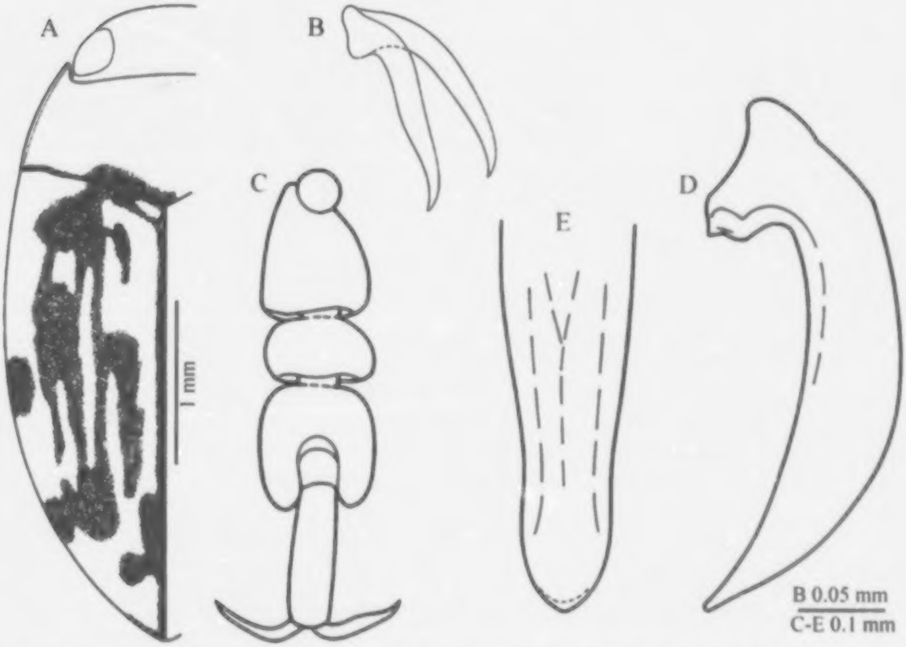


Fig. 60. *Neoporus dimidiatus* (Gemminger and Harold). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus semirufus LeConte 1855: 296. Type locality - Fort Laramie, Wyoming. Type - MCZC, sex not determined, no. 6009, examined. [not Germar 1845].

Hydroporus dimidiatus Gemminger and Harold 1868: 432 . New name for *Hydroporus semirufus* LeConte.

Hydroporus solitarius Sharp 1882*a*: 445. Type locality - Massachusetts. NEW SYNONYMY. Type not examined.

Selected References. Fall 1923: 43 – 45; Larson 1975: 287.

Description. Length = 3.8 to 4.4 mm; width = 1.9 to 2.3 mm; length: width = 1.85 to 2.00. Body outline and color pattern as in Fig. 60A.

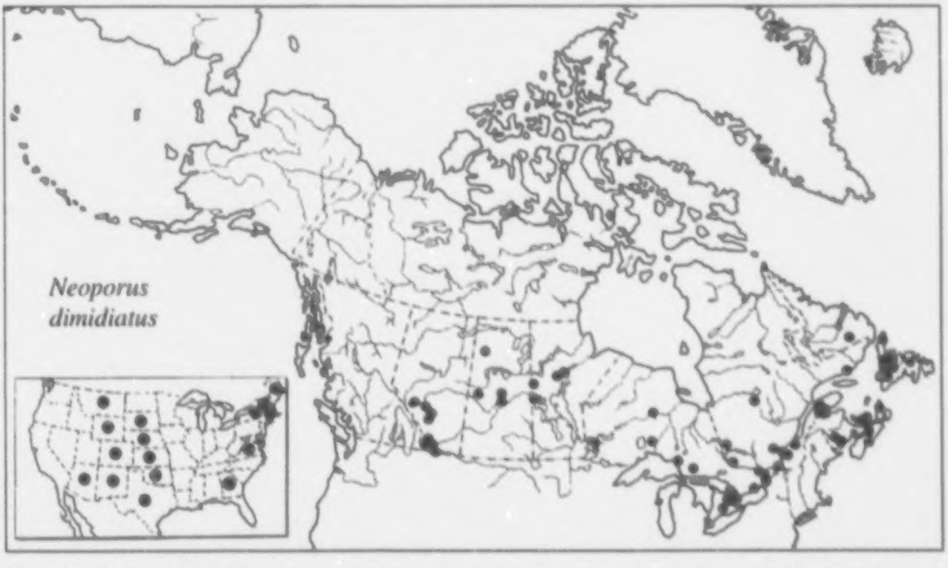
Head yellow; antenna and palpi entirely yellow, without apical infuscation. Pronotum yellow with a small brown or piceous spot medially on anterior margin; basal margin narrowly lined with piceous at least medially. Elytron with dark maculation various, on darkest specimens entire disc piceous with only humeral angle, lateral margin and elytral apex yellow; most specimens with dark maculation consisting of four discal vittae and a mediolateral spot, these tending to coalesce at base, middle and postmedially but most specimens with at least a subsutural yellow stripe extending from base to posterad of middle so that some pale areas on basal half of elytra are connected to pale postmedial pale areas. Ventral surface yellow to reddish yellow.

Punctation of dorsal surface relatively dense, with short but conspicuous setae. Metasternum, metacoxal plate and sterna 1 and 2 with punctures of moderate size but dense and almost contiguous; epipleuron densely, finely punctate, surface appearing granular.

Clypeus not or slightly thickened anteriorly. Pronotum with lateral bead distinct, gradually broadened anteriorly. Elytron with lateral margin arcuate and ascendant anteriorly in lateral aspect. Prosternum shallowly declivitous, file weak. Metasternum shallowly sulcate medially.

Male protarsus (Fig. 60C) evidently dilated; anterior protarsal claw (Fig. 60B) subequal to posterior claw, strongly bent basally, ventral margin sinuate. Aedeagus (Fig. 60D, E) short and broad.

Comments. The relationship between *N. solitarius* and *N. dimidiatus* is unresolved. *N. dimidiatus* differs from *N. solitarius* in larger size (length = 4.1 to 4.8 versus 3.8 to 4.2 mm (Fall 1923)), thickening of clypeus, punctation and color. However, none of these characters are constant and Alberta specimens are intermediate between the two. We interpret the possession of intermediate characters by specimens from intermediate localities as indicative of gene flow within a single species. In fact, there is no geographical discontinuity in the distribution of a character state that would permit recognition of subspecies even though specimens from the southwestern United States



Map 81. *Neoporus dimidiatus* (Gemminger and Harold). Canadian and Alaskan collection localities and United States state records.

look different from those of eastern North America. The species *N. arizonicus* Fall 1917, which occurs in New Mexico and Arizona, also belongs to this complex. It is characterized by more extensively infuscate pronotum, slightly larger size and rather dense punctation. It may also prove to be another geographical form.

Ecology. This species occurs in spring-fed pools, beaver ponds and protected shorelines of lakes and larger rivers, generally where there are open stands of emergent sedges or rushes.

Distribution. Map 81. This species has a very wide distribution in North America. It occurs across Canada from Newfoundland to Alberta, and south along the Appalachian Mountains to northern Georgia, and south along the Rocky Mountains to Texas, New Mexico and Arizona.

13. *Neoporus superioris* (Balfour-Browne 1944)

Fig. 61

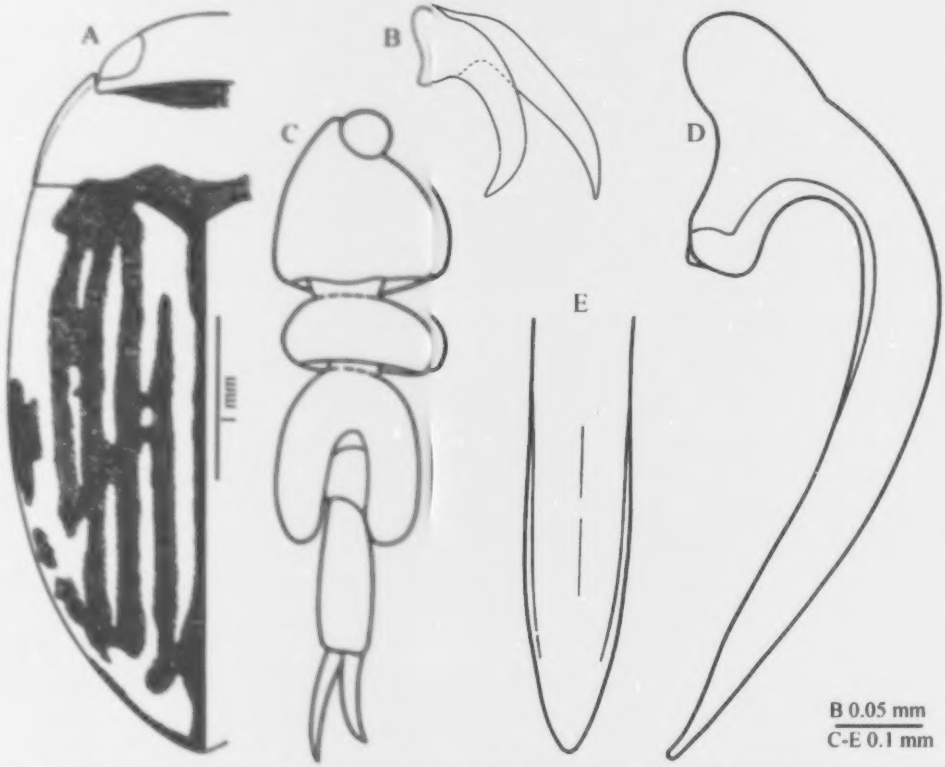


Fig. 61. *Neoporus superioris* (Balfour-Browne). A - left body outline, dorsal. B - male protarsal claws, anterior aspect. C - male protarsus. D - aedeagus, lateral. E - aedeagus apex, dorsal.

Hydroporus sericeus LeConte 1850: 214. Type locality - Lake Superior [not Eschscholtz 1818].

Hydroporus superioris Balfour-Browne 1944: 349. New name for *H. sericeus* LeConte.

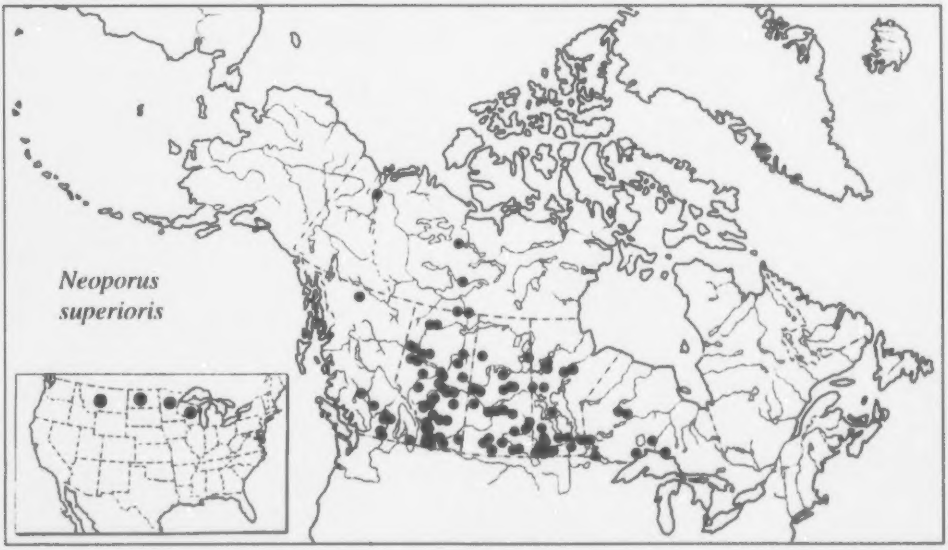
Selected References. Larson 1975: 288 - 289; Hilsenhoff 1995: 20.

Description. Length = 4.3 to 4.8 mm; width = 2.2 to 2.5 mm; length: width = 1.82 to 1.95. A moderately large species with a longitudinally oriented elytral pattern (Fig. 61A).

Ground color of body pale rufous. Antenna with at least apical antennomere infuscate, antennomeres 7 to 10 also darkened on many specimens. Pronotum with anterior margin bordered with piceous along anterior emargination; basal margin with a piceous spot medially which on some specimens extends laterally to posterolateral angles. Elytron basically yellow with sutural margin, base, four longitudinal discal vittae and a mediolateral spot, piceous; however many specimens with dark markings expanded and discal vittae variously fused to each other and isolating a number of longitudinal pale spots, or extreme specimens with entire disc dark with only lateral margins pale; general pattern one of longitudinal markings and almost all specimens have a subsutural pale stripe that extends continuously through basal two-thirds of disc.

Dorsal punctation dense, surface covered with dense, short golden setae; pronotum with punctures longitudinally confluent along hind margin; elytron with punctures closely set and on many specimens more or less transversely confluent. Ventral surface more coarsely punctate than elytra, punctures dense and separated by less than their own diameters; epipleuron finely but densely punctate.

Clypeus slightly thickened anteriorly. Pronotum with lateral bead narrow basally, gradually broadened anteriorly. Elytron with lateral margin more or less straight or slightly ascendant to humeral angle, epipleuron visible almost to shoulder in lateral aspect. Prosternum with prominence very large. Metasternum at most shallowly sulcate medially, rounded laterally. Metafemur with scattered golden setae on posterobasal margin.



Map 82. *Neoporus superioris* (Balfour-Browne). Canadian and Alaskan collection localities and United States state records.

Male protarsus (Fig. 61C) dilated, protarsomeres 1 and 2 bearing many small, oval adhesive scales on ventral surface; anterior protarsal claw (Fig. 61B) shorter, broader and more strongly arcuate than posterior claw. Aedeagus (Fig. 61D, E) elongate, more or less straight apically in lateral aspect.

Ecology. Specimens occur in permanent, warm water, usually on a sand or clay substrate among emergent sedges or rushes. The species is found in both slowly flowing streams and impoundments on streams, as well as along protected lake shores.

Distribution. Map 82. This is the most northerly and westerly species of the genus, ranging from western Ontario to British Columbia and north to Aklavik, Northwest Territories.

Genus *Hydroporus* Clairville 1806

Figs. 2D, I; 23B; 62 – 105.

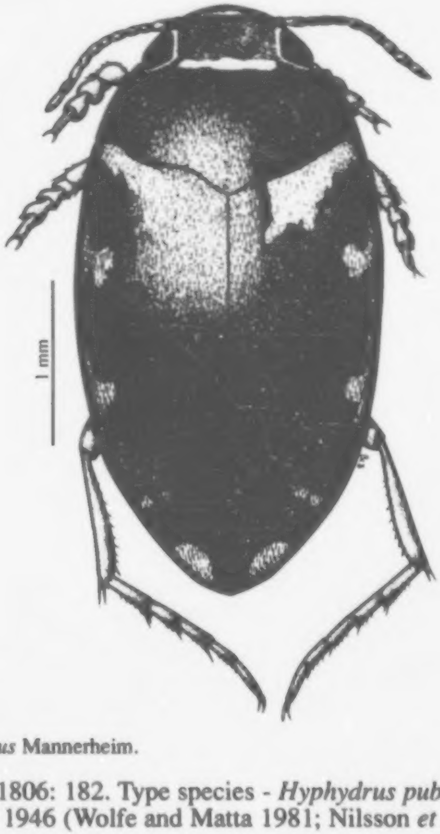


Fig. 62. *Hydroporus signatus* Mannerheim.

Hydroporus Clairville 1806: 182. Type species - *Hyphydrus pubescens* Gyllenhal, designated by Guignot 1946 (Wolfe and Matta 1981; Nilsson *et al.* 1989).

Diagnosis. Size small to moderate, length = 2.6 to 7.1 mm. Body elongate-oval (Fig. 62), width and convexity moderate; outline in dorsal aspect continuous or with posterolateral angle of pronotum slightly to evidently rounded and outline slightly to evidently discontinuous.

Color of dorsal surface reddish to black, some specimens with elytra more or less distinctly maculate; ventral surface with at least metathorax and basal abdominal sterna piceous to black, most specimens mainly black ventrally.

Body with microreticulation variously developed, absent to strong. Dorsal surface variously punctate, setose but length and density of setae various.

Clypeus simple, anterior margin not modified. Pronotum without a sublateral longitudinal impressed line or crease on each side; lateral bead narrow to moderate in width. Elytron in lateral aspect with lateral margin straight to strongly ascendant to humeral angle; epipleuron without a transverse carina on shoulder; ventral surface lacking a prominent subapical internal ligula; without a subapical lateral tooth. Prosternum (Fig. 2D) with declivity of process evident but variously developed, most specimens with a distinct file (series of transverse grooves) at base of neck delimited behind by a transverse ridge or prominence; prosternal process narrow, strongly convex medially and with apex contacting metasternum. Metacoxal processes (Fig. 23B) conjointly with hind margin truncate or slightly produced medially, but not strongly bisinuate (emarginate each side of midline) or incised along midline. Metatrochanter of moderate length. Metafemur with ventral face bearing a longitudinal row of punctures, not densely and confluently punctate.

Male antenna not modified. Protarsomeres 1 to 3 slightly to distinctly broadened, with a various number of enlarged adhesive setae beneath; protarsal claws modified or not. Parameres subequal in length to aedeagus, symmetrical, triangular in shape; aedeagus simple, apex pointed.

Comments. These small beetles are diverse and numerically abundant in many shallow aquatic habitats, especially near the water margin amongst emergent vegetation. In spite of their abundance, little is known about the life history, habitat or distribution of most species. The major reason for this is that the group is taxonomically very difficult. Even the limits and definition of this genus have been in a state of taxonomic flux. For example, Larson (1975), following Fall (1923) and Hatch (1953), treated *Hydroporus* in a very conservative manner because many of the genera proposed at the expense of *Hydroporus* lacked adequate definition. Since then, Wolfe (1985, 1989), Wolfe and Matta (1981), Zimmerman (1982) and Nilsson and Angus (1992) have studied the supraspecific classification of the Nearctic Hydroporinae and have clearly demonstrated the existence of several groups of generic or subgeneric ranking within *Hydroporus* sensu lato. The definition of *Hydroporus* used here is in accord with the concept of most European workers (e.g., Nilsson 1983*a*, Angus 1985, Nilsson and Holmen 1995) and corresponds to the *Hydroporus niger-tenebrosus* group of Fall (1923). Nilsson (1989) synonymized several genus-group names proposed for European species with *Hydroporus*.

The most recent review of the North American species is that of Fall (1923) who discussed 43 Nearctic species within the *H. niger-tenebrosus* group. Although Fall's species concepts are very good, his work suffers from the limited amount of material he had to work with, and his revision is difficult to use because of the lack of illustrations and his reliance on qualitative, gradational characters. Since Fall's (1923) revision, new species have been described and new synonymy proposed so that the work is outdated. A more recent revision was undertaken by Gordon (1969), but with the exception of descriptions of new taxa (Gordon 1981), this work has not been published. However, we were privileged to have access to this dissertation and with Dr. Gordon's permission, have drawn from it freely in the preparation of descriptions and the delineation of distribution of species. In the following treatment, all North American species have been included except *Hydroporus discicollis* Say 1834: 446. This species was described from a single specimen taken on Long's Expedition to the source of St. Peters River (= Minnesota R.) but the type is lost. This name is often associated with *H. dichrous* Melsheimer 1844 and if these two names are synonyms then *H. discicollis* is the older name. However, the description is inadequate to definitely determine its application to any species so we regard the species as *incertae sedis*.

The classical characters of external morphology, including the male genitalia, are inadequate to resolve the patterns of relationship among species. The characters of size, shape, color, punctation and sculpture, so important in species recognition, are of little value in defining species groups because of their high degree of variation and probable parallel development in various sections of the genus. Recent work on larvae (Nilsson 1986*b*, 1987*a*, 1989*b*; Nilsson and Carr 1989; Alarie 1991) shows that while characters for species recognition exist, larvae may not make resolution of classification any easier.

Species recognition is difficult in certain sections of the genus. The species show few striking differences, even in the male protarsi and genitalia. Shape, color and punctation are among the most useful characters but because they are qualitative, they are best used in a comparative sense. For purposes of identification, it is recommended that series of specimens be used and that the specimens be carefully cleaned and mounted on points so that the underside of the body is visible. Specimens in fluid, as well as dirty specimens, can be very difficult to identify.

As a first step in developing a classification of the members of the genus we have arranged the species into species-groups, following those of Nilsson and Holmen (1995) as much as possible. Some of these groups are poorly defined and are more or less units of convenience although others are quite distinctive and are probably monophyletic. These species-groups have been used in organizing species treatments but are not used in the key to species.

The following key is admittedly difficult to use because many of the characters are qualitative differences in shape that are best appreciated when comparative material is available. However, through reference to the key, group diagnosis and the species descriptions, reliable identification of most specimens should be possible. Considerable use has been made of length and it is recommended that the length of a specimen be measured before starting. The size ranges given include all the extreme specimens that have been seen, thus if the specimen being keyed falls outside a given species range, the probability is very high that it does not belong to the species. It is possible to proceed rather quickly through the key referring primarily to size. The width and shape of male protarsomeres 1 to 3 are valuable characters for species identification. In order to facilitate comparison, a protarsal ratio is given which is the ratio of the dorsal width of each of protarsomeres 1 to 3 to the maximum width of the protibia in anterior aspect.

Key to Species of *Hydroporus* of North America

1. Head, pronotum and ventral surface of body yellow brown to rufous; elytron in lateral aspect strongly ascendant anteriorly, epipleuron visible to humeral angle (Fig. 63B); body very coarsely punctate; pronotum with basolateral margin strongly concave, posterolateral angle produced and acute (Fig. 63A); length = 3.5 to 5.0 mm; western arctic .... 1. *H. sibiricus* J. Sahlberg

1'. Color various, most specimens with disc of pronotum and ventral surface piceous to black, but if paler combination of characters not as above 2

2(1). Head rufous or with frons darkened mesad to each eye; pronotum rufous to rufopiceous, on many specimens concolorous with or paler than elytra; body in dorsal aspect subparallel medially and attenuate posteriorly, pronotum and elytron with lateral margins continuous; elytron in lateral aspect with lateral margin straight or at most very faintly sinuate near humeral angle (Figs. 65B; 66B) 3

2'. Combination of characters not as above; color various, head and pronotum of most specimens largely piceous to black; body in dorsal aspect more rounded laterally and not evidently subparallel, or if elongate, pronotum with disc black; elytron in lateral aspect with lateral margin straight or ascendant to humeral angle 8

3(2). Metasternum with medial line impressed to form a small, oval fovea at base of anteromedial lobe; male anterior protarsal claw short, two thirds length of posterior claw (Fig. 64B); length = 3.4 to 4.3 mm; Quebec and Ontario south to Minnesota, Missouri and Maryland .... 2. *H. dichrous* Melsheimer

3'. Metasternum with medial line variously impressed but not forming a distinct fovea at base of anteromedial lobe; male anterior protarsal claw subequal in length to posterior claw; length various 4

4(3). Body broad, length: width = 1.75 to 1.83; body widest near base of elytra and distinctly tapering posteriorly; elytron with apical pale spot; length = 3.18 to 3.75 mm; Minnesota and Indiana east to Quebec and New Jersey .... 3. *H. melsheimeri* Fall

4'. Body more elongate, length: width = 1.88 to 2.12; body parallel-sided from base of elytra past mid-length; elytron without distinct apical spot but some specimens with apex broadly paler 5

5(4). Antenna longer, antennomeres 5 to 10 about one and three quarters times as long as wide; male protarsus distinctly widened (Figs. 64H; 65D); length = 3.7 to 4.3 mm 6

5'. Antenna shorter, antennomeres 5 to 10 not more than one and one half times as long as wide; male protarsus not distinctly widened (Fig. 66C, F); length = 2.9 to 3.9 mm 7

6(5). Male anterior protarsal claw not toothed (Fig. 64I); female protarsus in lateral aspect with anterior claw shorter than exposed portion of protarsomere 5; northeastern United States, south to North Carolina . . . . 4. *H. americanus* Aubé

6'. Male anterior protarsal claw with large subapical tooth (Fig. 65C); female protarsus in lateral aspect with anterior claw equal to or longer than exposed portion of protarsomere 5; transcontinental, boreal species south to New Jersey . . . . 5. *H. dentellus* Fall

7(5). Length = 2.8 to 3.3 mm; male protibia more or less straight on inner margin and not abruptly constricted at base; male protarsomere 3 rounded laterally but not symmetrical, posterior lobe longer than anterior (Fig. 66C); transcontinental, boreal species, Alaska to Newfoundland . . . . 6. *H. obscurus* Sturm

7'. Length = 3.4 to 3.9 mm; male protibia sinuate on inner margin and abruptly constricted at base; male protarsomere 3 rounded laterally and symmetrical in outline (Fig. 66F); Newfoundland to Michigan south to Florida and Mississippi . . . . 7. *H. brevicornis* Fall

8(2). Length = 4.1 to 5.6 mm; pronotum in dorsal aspect with lateral bead at least slightly inflated on anterolateral angle, in lateral aspect lateral margin reflexed upwards at anterolateral angle broadly exposing proepipleuron (Fig. 68B); male protarsal claws (Fig. 68C) elongate, toothed basally, strongly arcuate basally and apically; male pro- and mesotarsomere 1 with numerous small, adhesive scales ventrally; transcontinental, boreal and arctic . . . . 9. *H. notabilis* LeConte

8'. Length various; pronotum in dorsal aspect with lateral bead various but not distinctly inflated on anterolateral angle, in lateral aspect lateral margin more or less straight or evenly arcuate or at most slightly reflexed upwards at anterolateral angle; male protarsal claws various but not so elongate and strongly bent apically; male pro- and mesotarsomeres 1 with various number of adhesive scales on ventral surface 9

9(8). Elytron in lateral aspect with lateral margin straight to very slightly sinuate at base (Figs. 69B; 71B); pronotum in dorsal aspect with hind margin rather strongly concave mesad of posterolateral angle and angle acutely produced (Figs. 62; 69A; 71A); prosternum in lateral aspect with prominence distinct, on many specimens with apex more or less right angled; male anterior protarsal claw subequal to or shorter than posterior, strongly arcuate basally, ventral margin faintly to distinctly sinuate; aedeagus in ventral aspect relatively broad, apex variously produced as a distinct knob (Figs. 69E – G; 71F, G); length = 3.3 to 5.5 mm 10

9'. Elytron in lateral aspect with lateral margin at least slightly ascendant; pronotum in dorsal aspect various, hind margin straight to strongly concave laterally, posterolateral angle obtuse to acute; prosternal prominence various; male anterior protarsal claw various in shape; aedeagus various but more or less evenly narrowed apically on most specimens; length various 14

10(9). Male anterior protarsal claw distinctly shorter than posterior claw (Fig. 69C); head dorsally rufous except a dark spot mesad to each eye and hind margin narrowly piceous 11

10'. Male protarsal claws subequal in length; head color various, ranging from entirely rufous to mainly dark with anterior margin and frontal bar pale 12

11(10). Eastern North America, Ontario and Newfoundland to South Carolina and Texas; elytron with punctures fine and dense; length = 4.2 to 5.0 mm . . . . 10. *H. niger* Say

11'. Florida and Alabama; elytron with punctures large and distinct; length = 4.2 to 4.6 mm . . . . 11. *H. falli* Blatchley

12(10). Head rufous, most specimens without spots or infuscation on frons; length = 4.8 to 5.5 mm; Massachusetts south to Florida, east of the Appalachian Mountains . . . . .12. *H. ruficeps* Aubé

12'. Head darker, either rufous with a large dark spot mesad to each eye or frons between eyes and along posterior margin brown to rufopiceous; length = 3.3 to 4.7 mm 13

13(12). Length = 4.0 to 4.7 mm; elytron without distinct markings, at most humeral angle and apex diffusely paler; aedeagus (Fig. 70F, G) in ventral aspect distinctly constricted at middle, apex with a small projection and a longitudinal carina; body dorsally with microreticulation fine, surface shiny on both sexes; Maryland to Michigan and Minnesota south to Florida and Texas . . . . .13. *H. rufilabris* Sharp

13'. Length = 3.3 to 4.0 mm; color various, elytron of most specimens with a pale subbasal transverse band extending onto disc from shoulder, many specimens also with lateral or sublateral spots located antemedially, postmedially and subapically; aedeagus (Fig. 71F, G) in ventral aspect with a slight medial constriction, apex slightly produced; body dorsally with microreticulation various, lightly impressed and body shiny on males and some females; some females with sculpture dense, body matte; Newfoundland to Alaska south to Alabama and Wyoming . . . . .14. *H. signatus* Mannerheim

14(9). Length = 4.1 to 5.0 mm; pronotum with lateral bead very narrow, poorly defined or obsolete; body (Figs. 73A, B; 74A, B) in dorsal aspect with lateral margin of pronotum and elytra discontinuous in outline, markedly so on most specimens and some with pronotum widest clearly anterior to hind angles; elytron in lateral aspect strongly ascendant to humeral angle and epipleuron visible to or almost to shoulder 15

14'. Combination of characters not as above 17

15(14). Pronotum with a shallow median impression on disc, area around impression impunctate or sparsely and finely punctate, this region delimited posteriorly by an ill-defined transverse depression, best developed sublaterally; prosternum in lateral aspect with prominence obsolete or broadly obtuse; sternum 6 sparsely and shallowly punctate basally and medially; length = 4.2 to 5.0 mm; arctic and boreal species, Newfoundland to Alaska ....16. *H. lapponum* (Gyllenhal)

15'. Pronotum with entire disc bearing coarse punctures but punctures may be more widely separated medially than laterally; without or at most with a very faint transverse depression on basal third of disc; prosternum in lateral aspect with prominence distinct, right angled to acute; sternum 6 moderately coarsely, evenly punctate; Cordilleran ...16

16(15). Pronotum piceous with sharply delimited pale margins; elytron with well developed maculations, humeral band extended well onto disc, most specimens also with ante- and postmedial and apical pale spots adjacent to lateral margin; length = 4.1 to 4.7 mm; Alaska and Alberta south to California .... 17. *H. mannerheimi* Balfour-Browne

16'. Pronotum dark rufous to brown, diffusely paler laterally; elytron with maculation less well developed, consisting of at most humeral and subapical spots; length = 4.1 to 4.8 mm; British Columbia and Alberta south to California and Wyoming ....18. *H. tademus* Leech

17(14). Length = 4.5 mm or greater 18

17'. Length less than 4.5 mm 30

18(17). Length = 6.0 to 7.1 mm; pronotum with fine, dense, more or less even punctation; metacoxal plate with punctation shallow and obscured by microreticulation; sternum 6 densely punctate; head with ventralsurface black; British Columbia south to California ....19. *H. fortis* LeConte

18'. Length = 6.3 mm or less, if greater than 6.0 mm, then pronotum less densely punctate medially than laterally, metacoxal plate with distinct well separated punctures, sternum 6 finely and sparsely punctate and head ventrally reddish 19

19(18). Protibia (Fig. 98B) with a ventrobasal emargination, inner (ventral) margin sinuate in anterior aspect, sinuation distinct in female but less developed than on male; length = 4.9 to 5.9 mm; British Columbia to California ....45. *H. sinuatipes* Fall

19'. Protibia without a ventrobasal emargination, inner margin more or less straight or evenly curved 20

20(19). Sternum 6 with punctation dense, punctures crowded and more or less contiguous posteromedially; pronotum medially densely punctate, hind margin strongly bisinuate on each side of middle 21

20'. Sternum 6 with punctation various but punctures not strongly crowded posteromedially; pronotum medially less densely or less coarsely punctate, hind margin bisinuate or not on each side of middle 22

21(20). Head ventrally rufous to brownish; pronotum medially with evident microreticulation; pronotum with lateral bead of more or less uniform width throughout length; metacoxal plate with microreticulation coarse, punctures obscure and barely visible; male protarsal claws similar in length, subequal to or longer than protarsomere 5; length = 5.3 to 5.5 mm; California .20. *H. leechi* Gordon

21'. Head ventrally piceous to black; pronotum medially with interspaces shiny, microreticulation absent on males lightly impressed or absent on females; pronotum with lateral bead narrow posteriorly and gradually broadening anteriorly; metacoxal plate microreticulate but sculpture regular and the very fine punctures evident; male protarsal claws (Fig. 80C) distinctly unequal, anterior claw much shorter than protarsomere 5; length = 4.6 to 5.4 mm; Washington south to California and New Mexico . . . . .23. *H. axillaris* LeConte

22(20). Length = 5.0 to 6.3 mm; head rufous except dorsally with hind margin and a triangular spot mesad to each eye, piceous; male anterior protarsal claw (Fig. 78C) about two thirds length of posterior, evenly arcuate and narrowed over length; male protarsomere 1 with numerous rounded scales beneath; New Brunswick and New England west to Northwest Territories and British Columbia and south to Wyoming . . . . 21. *H. columbianus* Fall

22'. Length = 5.5 mm or less; head dorsally piceous to black with at most anterior margin and frontal bar rufous; male anterior protarsal claw subequal in length to or slightly shorter than posterior claw; male protarsomere 1 with number of ventral scales various 23

23(22). Head ventrally entirely black; hind legs distinctly bicolored on most specimens, metafemur dark piceous to black and contrasting with rufescent metatibia; elytron with punctures various but on many specimens punctures small and arranged in irregular transverse rows; elytron with microreticulation various, many specimens with lines effaced posterad to each puncture, or some females with meshes transverse in shape; male protarsomere 1 with numerous small oval scales on ventral surface, protarsomeres 2 and 3 relatively small and circular in outline (Fig. 94B); length = 4.5 to 5.2 mm; Alaska and Alberta south to California, Arizona and New Mexico . . . . 37. *H. transpunctatus* Chandler (in part)

23'. Head ventrally with at least gula, and many specimens also with genae rufous; hind legs with metafemur darkened medially but not strongly contrasting with paler metatibia; elytron with punctures not forming transverse rows, microreticulation more regularly impressed, meshes not transverse; male protarsomere 1 with 4 to many ventral scales, protarsomere 3 elongate-oval 24

24(23). Body relatively coarsely and densely punctate, elytron with punctures separated by their own diameters or less, sternum 6 densely punctate with punctures along hind margin more or less contiguous; body outline (Fig. 79A) discontinuous in dorsal aspect, pronotum with lateral margin somewhat flattened and explanate; head with ventral surface red; springs of Death Valley system, southern Nevada (and California?) .... 22. *H. zackii* new species

24'. Body less coarsely punctate; combination of characters not as above; not in Death Valley system of California and Nevada 25

25(24). Labial palpus entirely yellow, lacking infuscation or with only faintest apical darkening; head ventrally rufous; body notably elongate, subparallel (Fig. 105A); metacoxal plate with punctures small, separated on average by two or more times their own diameters; sternum 6 with punctures small but deep, widely and evenly separated and not crowded towards hind margin; boreal, transcontinental; length = 4.2 to 4.7 mm .... 54. *H. rectus* Fall (in part)

25'. Labial palpus distinctly infuscate apically (teneral specimens and some bleached specimens with palpi entirely yellow); head ventrally rufous or with genae darkened; body more oval in dorsal aspect, sides not so distinctly subparallel; metacoxal plate with punctation various, most specimens with punctures large and separated by less than two times their own diameters; sternum 6 variously punctate; widely distributed but in boreal zone only east of Great Plains 26

26(25). Boreal, east of Great Plains (Newfoundland to Ontario, New York and Michigan); head ventrally with gula rufous, genae black; elytron coarsely punctate; metacoxal plate with punctures coarse and dense; sternum 6 with punctures relatively fine; male protarsomere 1 with 3 pairs of scales; length = 4.3 to 5.0 mm .... 55. *H. gossei* new species (in part)

26'. West of Great Plains; head ventrally largely rufous or with genae piceous; punctation various; male protarsomere 1 with 2 or 3 pairs of scales 27

27(26). Male protarsi narrow, protarsomeres 1 and 2 subequal in width, both wider than protarsomere 3 (Fig. 97B, E) 28

27'. Male protarsi broad, protarsomere 2 broader than either 1 or 3 which are subequal in width (Fig. 97J) 29

28(27). Smaller, length = 3.7 to 4.6 mm; protarsal ratio = 0.74: 0.74: 0.65; British Columbia to Arizona and California .... 41. *H. hirtellus* LeConte (in part)

28'. Length = 4.4 to 5.0 mm; protarsal ratio = 0.76: 0.77: 0.69; California .... 42. *H. simplex* Gordon (in part)

29(27). Smaller, length = 3.9 to 4.8 mm; protarsal ration = 0.82: 0.89: 0.84; British Columbia to Oregon .... 43. *H. similaris* Fall (in part)

29'. Length = 4.6 to 5.2 mm; protarsal ratio = 0.85: 0.95: 0.85; British Columbia to California ....44. *H. subpubescens* LeConte (in part)

30(17). Pronotum medially, elytron basomedially and metacoxal plate shiny, without microreticulation on most specimens; some females with very lightly impressed lines on elytron and metacoxal plate 31

30'. Entire body with microreticulation although lines may be lightly impressed on pronotum and base of elytron of some males 32

31(30). Protibia with anterior face bearing two longitudinal rows of punctures or punctures irregularly scattered over surface; pronotum black with at most lateral bead and side adjacent to bead narrowly piceous; genae and proepisternum piceous; sternum 6 with punctures crowded along hind margin; male with intralinear space of metacoxae densely punctate and bearing a brush of short, suberect brown setae; length = 2.9 to 3.5 mm; Newfoundland to Alaska, south to Colorado ....28. *H. fuscipennis* Schaum

31'. Protibia with anterior face bearing a single longitudinal row of punctures; pronotum of most specimens dark brown to piceous, lateral margin broadly rufous; head ventrally and proepisternum rufous; sternum 6 coarsely punctate, punctures evenly distributed; male metacoxae with intralinear space lacking dense brush of setae; length = 2.9 to 3.3 mm; Labrador to Yukon Territory, south to Minnesota ....30. *H. larsoni* Nilsson

32(30). Metacoxae with intralinear space finely and densely punctate and bearing a dense brush of short, suberect yellow setae (setae may be very short or absent from some females but finely punctate area still evident); male metatrochanter with hind margin bearing a dense fringe of yellow setae; protibia with anterior face bearing two irregular longitudinal rows of punctures; length = 2.7 to 3.4 mm; arctic species, Quebec to Alaska ....29. *H. polaris* Fall

32'. Metacoxae with intralinear space not finely and densely punctate, without a brush of short setae; male metatrochanter without setae on hind margin; protibia with a single longitudinal row of punctures on anterior face or some specimens with row irregular or broken in basal half 33

33(32). Protibia with longitudinal row of punctures of anterior face double basally or at least some scattered punctures present laterad of longitudinal row in basal half making row appear somewhat irregular or broken; metacoxal processes conjointly with hind margin distinctly produced and angulate; west of Rocky Mountains; length = 3.4 to 4.3 mm ....40. *H. longiusculus* G. and H.

33'. Protibia with a single, coherent longitudinal row of punctures on anterior face; metacoxal processes with hind margin various; widely distributed; length various 34

34(33). Male anterior protarsal claw with a large ventral tooth (Fig. 83C); female pronotum in dorsal aspect with lateral margin not evenly arcuate on most specimens, margin straight or slightly concave and sinuate along anterior half (Fig. 83G); pronotum with hind angle obtuse (Fig. 83A, G, H), many specimens with lateral margin of pronotum and elytron discontinuous in dorsal aspect; color mainly black; punctation coarse; length = 3.0 to 3.6 mm; transcontinental arctic and northern boreal species, Greenland to Alaska, south to Michigan . . . . .26. *H. morio* Aubé

34'. Male anterior protarsal claw lacking a ventral tooth; female pronotum with lateral margin evenly arcuate along its length; color, punctation and length various 35

35(34). Length = 2.8 to 3.5 mm 36

35'. Length greater than 3.5 mm 43

36(35). Prosternal process with its base extended anteriorly onto prosternum as a short convex ridge; prosternum anterior to each procoxa with an anteromedially directed ridge; head rufous with a large infuscate spot mesad to each eye; pronotum black and somewhat contrasting with rufopiceous elytra; body in dorsal aspect (Fig. 84A) with lateral margins of pronotum and elytra discontinuous in outline on most specimens, hind angle of pronotum about right angled; length = 2.8 to 3.2 mm; Newfoundland to Alaska, south to New Jersey and Oregon . . . . .27. *H. tristis* Paykull

36'. Prosternal process not traceable onto prosternum as a short convex ridge; prosternum anterior to each procoxa with or without an anteromedially directed ridge; color and body outline various 37

37(36). Body in dorsal aspect with lateral margins of pronotum and elytra discontinuous in outline (Figs. 81A; 82A); pronotum with point of maximum width anterior to obtuse hind angles on most specimens; pronotum black; length = 2.8 to 3.2 mm 38

37'. Pronotum and elytra with curvature of lateral margins more or less continuous in dorsal aspect; pronotum with point of maximum width at hind angle OR if maximum width slightly anterior to hind angle, pronotum rufous to piceous, at least laterally; length various 39

38(37). Head dorsally with a sharply delimited bright rufous triangular spot on clypeus and anteromedial portion of frons; length = 2.9 to 3.2 mm; transcontinental, boreal species, Nova Scotia to Alaska, south to Michigan . . . . .24. *H. rufinasus* Mannerheim

38'. Head anteromedially piceous, rufous areas, if present, restricted to anterior portion of clypeus and gradually darkened onto anterior portion of frons; length = 2.9 to 3.2; transcontinental, boreal species, Newfoundland to Alaska . . . . .25. *H. puberulus* LeConte

39(37). Length = 2.6 to 3.0 mm; pronotum black with lateral margin at most narrowly rufopiceous; elytron more or less uniformly reddish brown to piceous, slightly but distinctly paler than pronotum; pronotum with punctation fine and sparse medially, elytron coarsely punctate with punctures bearing short, inconspicuous setae; body in dorsal aspect (Fig. 67A) elongate-oval, elytra with margins subparallel on basal half; length = 2.6 to 3.0 mm; transcontinental, boreal species, Newfoundland to Alaska . . . . .8. *H. badiellus* Fall

39'. Length various but if 3.0 mm or less, pronotum with lateral margins broadly yellow to pale rufous, or elytra basomedially dark and similar in color to pronotum; combination of characters not as above 40

40(39). Length = 3.0 to 3.5 mm; male anterior protarsal claw broadened with a ventral flange that extends almost to apex (Fig. 93C); pronotum medially brown to piceous, seldom black, lateral margins broadly rufous; elytron basally and laterally paler than medially on disc on most specimens; sternum 6 with punctures small but apical half with reticulation coarse and punctures deeper and denser than basally; transcontinental, boreal species, Newfoundland to Alaska, south to Colorado . . . . 36. *H. striola* Gyllenhal

40'. Size various; male anterior protarsal claw at most slightly broadened and without a ventral flange; color various; sternum 6 with punctation and sculpture various 41

41(40). Length = 2.7 to 3.0 mm; pronotum black medially, lateral margin mesad to lateral bead, rufous; elytron with basal one fifth to one quarter yellow and sharply contrasting with darker more posterior portions of disc; pronotum coarsely punctate medially; sternum 6 with separated small, deep punctures; low arctic and northern boreal species, northern Manitoba to Yukon Territory and British Columbia . . . . 35. *H. boraeorum* new species

41'. Length = 3.0 mm or more; pronotum with color various, if disc black then lateral margins not sharply paler; elytron with color various, many specimens with base and lateral areas paler than disc but transition gradual; punctation various 42

42(41). Pronotum with disc medially very sparsely and finely punctate; body in dorsal aspect (Fig. 91A) with lateral margin discontinuous in outline, pronotum with point of maximum width slightly anterad of base, posterolateral angle right angled to slightly produced and acute, its apex deflexed downwards; pronotum of most specimens vaguely bicolored with basal half dark rufous to rufopiceous, anterior half darker; elytron pale basally and laterally but limits of pale area diffuse; sternum 6 with very small, sparse punctures; length = 3.1 to 3.4; low arctic species, northern Manitoba to Alaska . . 34. *H. aurora* new species

42'. Pronotum of most specimens with disc distinctly punctate medially although punctures smaller and sparser than near margins; body in dorsal aspect with outline various, most specimens with lateral margin of pronotum and elytron continuous, pronotum widest across hind angles; pronotum with disc unicolorous or paler only towards margins; elytron color various; sternum 6 with punctation various; wide distribution including low arctic 43

43(35,42). Head with ventral surface, including gula, black; metacoxal plate sparsely and shallowly punctate, punctures much shallower than those of metasternal wing and abdominal sterna 1 and 2; male protarsomere 3 small, almost circular in outline (Figs. 94B, F; 95A); Cordilleran . . .44

43'. Head color various, most specimens paler with at least gula yellow to reddish; metacoxal plate more coarsely punctate, punctures at most slightly smaller and sparser than those of metasternal wing and abdominal sterna 1 and 2; male protarsus various, protarsomere 3 ovate; widespread including Cordilleran 46

44(43). Elytral punctures of many specimens arranged in irregular transverse rows (best seen sublaterally); elytron of many specimens with microreticulation obsolete immediately posterad to each puncture; antenna very dark, infuscate from antennomere 1 or 2; length = 4.5 to 5.2 mm; Alberta and Alaska south to Colorado, Arizona and California . . . . 37. *H. transpunctatus* Chandler (in part)

44'. Elytral punctures not arranged in transverse rows; elytral microreticulation lightly impressed but not obsolete immediately behind each puncture; antenna with basal 3 or 4 antennomeres mainly yellow; Rocky Mountains and Oregon 45

45(44). Aedeagus (Fig. 94G, H) in dorsal aspect more or less evenly narrowed to pointed apex; body, especially disc of pronotum, finely and sparsely punctate; male protarsomere 2 subcircular; protarsomere 1 with three pairs of scales on ventral surface; protarsal claws elongate; length = 3.9 to 4.3 mm; Alberta and Saskatchewan south to Oregon and Utah . . . . .38. *H. carri* Larson

45'. Aedeagus (Fig. 95B, C) in dorsal aspect with apex shortly broadened and spatulate; body dorsally moderately punctate; male protarsomere 3 ovate; protarsal claws evenly and relatively strongly arcuate, anterior claw slightly shorter than posterior; length = 4.0 to 4.4; southern Oregon . . . . 39. *klamathensis* new species

46(43). Head with ventral surface yellow to rufous, without infuscation; labial palpus entirely yellow, not infuscate apically; lengh = 4.2 to 4.7 mm 47

46'. Head with ventral surface variously colored but most specimens with genae infuscate; labial palpus with apical palpomere infuscate; length various, most specimens smaller 48

47(46). Pronotum and elytra in dorsal aspect discontinuous in outline(Fig. 72A); pronotum medially dark rufous to rufopiceous,not black, lateral margins broadly rufous; aedeagus (Fig. 72D, E) in dorsal aspect broad with a small apical projection; length = 4.2 to 4.3 mm; Mexico ....15. *H. civicus* Sharp

47'. Pronotum and elytra in dorsal aspect with lateral margin continuous, body notably elongate and parallel-sided (Fig. 105A); pronotum medially black, lateral margins at most narrowly paler; aedeagus (Fig. 105F, G) in dorsal aspect slender, without a distinct apical projection; length = 4.2 to 4.7 mm; boreal, transcontinental ....54. *H. rectus* Fall (in part)

48(46). Length = 4.3 to 5.0 mm; body very coarsely and densely punctate; pronotum dark piceous to black; epipleuron piceous to black; head ventrally black with gula rufous; pronotum in lateral aspect with lateral margin of anterior angle flattened ventrolaterally; prosternum in lateral aspect with prominence obsolete, evident only as a slight discontinuity in outline; male protarsomere 1 with 8 or more scales on ventral surface; protarsomere 3 narrower than 2, elongate(Fig. 104E); protarsal claws subequal, not modified; east of Great Plains, Michigan and Newfoundland to New York and Maine ...55. *H. gossei* new species (in part)

48'. Size various, but if east of Great Plains, length less than 4.3 mm; body less densely punctate; color various; pronotum with lateral margin not flattened ventrolaterally on anterior angle; prosternum with prominence evident or not; male protarsomere 1 with 4 scales on ventral surface; protarsomere 3 and protarsal claws various; widely distributed 49

49(48). Male anterior protarsal claw about two thirds length of posterior, broader and more arcuate (Fig. 104A); metacoxal plate with punctures slightly to distinctly shallower than those of metasternal wing or sterna 1 and 2; protarsomere 3 slightly narrower than 2, about as long as wide; head ventrally with genae piceous to black, gula rufous; length = 3.8 to 4.2 mm; Great Plains and southern B.C. to Arizona and California ....52. *H. pervicinus* Fall

...................................53. *H. hirsutus* Gordon

49'. Male anterior protarsal claw subequal in length to, or very slightly shorter than, posterior claw; metacoxal plate with punctation various; protarsomere 3 various; head color various; size various; widely distributed 50

50(49). Length = 3.1 to 3.7 mm; pronotum and elytron dark brown, rarely piceous; elytron distinctly maculate with yellow lateral spots at base, antemedially, postmedially and subapically; head ventrally rufous, proepisternum entirely yellow; elytron with conspicuous yellow to pale brown setae which are one and one-half to two times as long as distance between punctures; sternum 6 finely and sparsely punctate basally, punctures slightly deeper and denser apically; habitat streams and margins of alpine and arctic lakes, east of Rocky Mountains, Maine to Yukon Territory, south to Colorado ....31. *H. appalachius* Sherman

50'. Combination of characters not as above; pronotum and elytra of most specimens darker, elytra without pale maculations or with humeral angle pale (some specimens of H. occidentalis have pale spots on elytra); color of head ventrally and proepisterna various; habitat various, generally lentic; widespread 51

51(50). Male protarsomere 3 very large, subequal in width to protarsomere 2, elongate oval in outline with sides evenly curved, protarsal ratio = 0.75: 0.80: 0.79 (Fig. 102C, G), mesotarsomere 3 similarly large and broadly oval; anterior protarsal claw subequal in length to posterior but slightly broader and more arcuate apically (Fig. 102F); female pro- and mesotarsomeres very narrow, tarsomeres 3 narrowly triangular; female with microreticulation fine and dense, surface of pronotum and elytron matte to slightly iridescent; head with ventral surface entirely rufous or variously infuscate laterally, pronotum with lateral margin broadly rufous, elytron brown to rufopiceous basomedially and on most specimens evidently paler than disc of pronotum; length = 3.5 to 4.4 mm; Alaska to Newfoundland south to Oregon and Pennsylvania ....50. *H. tenebrosus* LeConte

51'. Combination of characters not as above; male protarsomere 3 of various shapes but not so large; female microreticulation matte or not; female pro- and mesotarsomeres of varied width; many specimens with elytra darker, concolorous with disc of pronotum; length various 52

52(51). Length = 3.0 to 3.4 mm; color very dark brown to black; elytron of many specimens with humeral angle yellowish brown (some specimens with well defined yellow lateral spots at shoulder, antemedially, postmedially and subapically); antenna rather short and stout, antennomere 2 ovate and widest near middle; elytron coarsely punctate, punctures bearing dark setae about one to one and one half times as long as distance between punctures; pronotum broad, lateral margin relatively strongly rounded anteriorly; Cordilleran 53

52'. Length = 3.0 mm or more; color various, elytron non-maculate, humeral angle diffusely paler; antenna normal, slenderer, antennomere 2 more or less cylindrical; elytron with punctation and vestiture various; pronotum narrower, lateral margin more or less evenly arcuate; widely distributed 54

53(52). Pronotum and elytra in dorsal aspect with lateral margins more or less continuous (Fig. 89A); pronotum with hind angle slightly obtuse and narrowly rounded apically; sternum 6 with fine, sparse, irregular punctation; elytron with humeral angle distinctly paler than piceous disc on most specimens; femora in basal half distinctly infuscate; widely distributed in Cordilleran region; length = 2.9 to 3.4 mm; Alberta and Yukon Territory south to Utah ....32. *H. occidentalis* Sharp

53'. Pronotum in dorsal aspect with lateral margin more arcuate than lateral margin of elytron therefore body outline slightly discontinuous, pronotum with hind angle distinctly obtuse (Fig. 90A); sternum 6 with more or less evenly distributed, moderately coarse punctures; elytron more or less uniformly rufopiceous basally, without distinctly pale shoulders; femora reddish, gradually darkened basally; length = 3.3 mm;Utah . . . . .33. *H. spangleri* Gordon

54(52). Head ventrally with genae brownish yellow to rufopiceous; metacoxal plate relatively sparsely punctate, punctures separated by about 2x their own diameters or more; smaller species, length = 3.1 to 3.6 mm . . . . .46. *H. tartaricus* LeConte

54'. Head ventrally with genae infuscate, piceous to black, gula yellow to piceous or length greater than 3.7 mm; metacoxal plate more densely punctate, punctures of many specimens separated by less than 2x their own diameters; length various but generally larger, length = 3.0 to 4.5 mm 55

55(54). Pronotum with lateral bead relatively broad, about one half of basal width of antennomere 5 or 6; metacoxal processes conjointly with hind margin slightly but distinctly produced and angulate medially; Pacific coast, southwestern British Columbia to California and Arizona 56

55'. Pronotum with lateral bead narrow; metacoxal processes conjointly with hind margin truncate or very slightly and broadly rounded posteriorly; widely distributed, boreal and Cordilleran 59

56(55). Male protarsi narrow, protarsomeres 1 and 2 subequal in width, both wider than protarsomere 3 (Fig. 97B, E) 57

56'. Male protarsi broad, protarsomere 2 broader than either 1 or 3 which are subequal in width (Fig. 97J) 58

57(55). Smaller, length = 3.7 to 4.6 mm; protarsal ratio = 0.74: 0.74: 0.65;British Columbia to Arizona and California . . . . .41. *H. hirtellus* LeConte (in part)

57'. Length = 4.4 to 5.0 mm; protarsal ratio = 0.76: 0.77: 0.69; California . . . . .42. *H. simplex* Gordon (in part)

58(56). Smaller, length = 3.9 to 4.8 mm; protarsal ratio = 0.82: 0.89: 0.84; British Columbia to Oregon . . . . .43. *H. similaris* Fall (in part)

58'. Length = 4.6 to 5.2 mm; protarsal ratio = 0.85: 0.95: 0.85; British Columbia to California . . . . .44. *H. subpubescens* LeConte (in part)

59(55). Male protarsomere 3 slender, sides more or less straight and diverging apically (Fig. 100B, E, I); body shiny, male and many females with sculpture lightly impressed; vestiture fine, dark and inconspicuous; pronotum medially very sparsely and finely punctate; lateral bead narrow; body in dorsal aspect with point of maximum width at middle of elytra and farther posterad than normal; length = 3.0 to 4.1 mm; transcontinental, boreal species . . . .47. *H. nigellus* Mannerheim (in part)

59'. Male protarsomere 3 broader, sides curved and shape oval or quadrate (Figs. 101A, D; 103B, E); sculpture various, body of many specimens duller, sculpture deeper; vestiture conspicuous; pronotum more densely punctate, medial area of disc with intermixed small and larger setiferous punctures; body with point of maximum width more anterad 60

60(59). Male aedeagus length = 0.40 to 0.45 mm; protarsomeres robust, protarsomere 3 ovate (Fig. 101A, D); Cordilleran
. . . . .48. *H. geniculatus* Thomson
. . . . .49. *H. utahensis* Gordon

60'. Male aedeagus length = 0.45 to 0.54 mm; protarsomere 3 more elongate-oval (Fig. 103B, E); boreal and Cordilleran
. . . . .51. *H. despectus* Sharp

Hydroporus sibiricus-group

Fig. 63

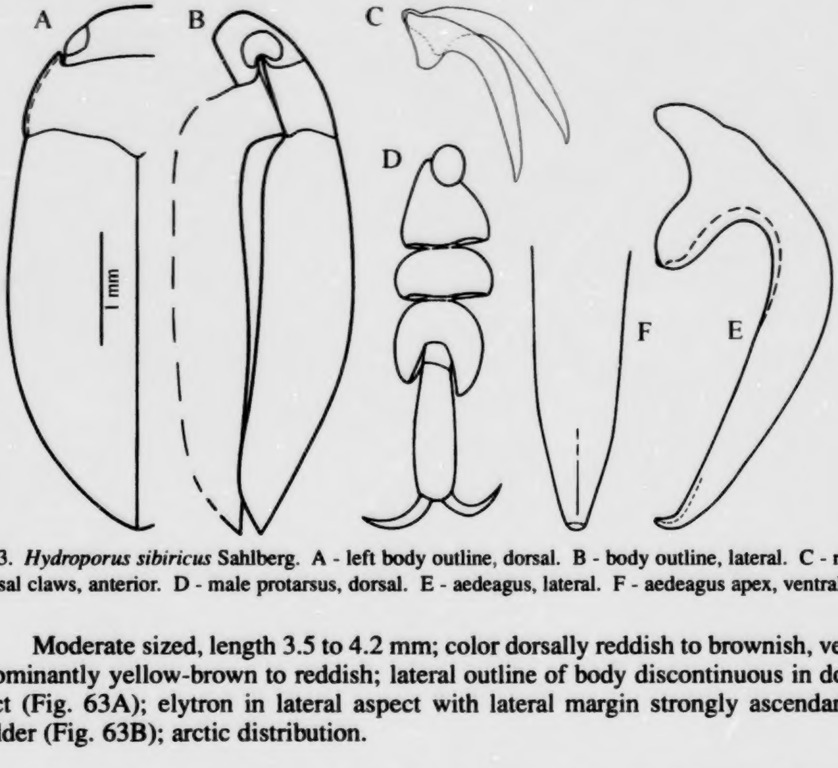


Fig. 63. *Hydroporus sibiricus* Sahlberg. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Moderate sized, length 3.5 to 4.2 mm; color dorsally reddish to brownish, venter predominantly yellow-brown to reddish; lateral outline of body discontinuous in dorsal aspect (Fig. 63A); elytron in lateral aspect with lateral margin strongly ascendant to shoulder (Fig. 63B); arctic distribution.

This small group contains one species in the northwestern Nearctic and two or three Palaearctic species.

1. *Hydroporus sibiricus* J. Sahlberg 1880

Fig. 63

Hydroporus sibiricus J. Sahlberg 1880: 49. **LECTOTYPE** here designated, in MZHF labelled: Kantaika/ J. Sahlbg./ J. Sahlb., ind. typ./ 1522 [small yellow label]/ *H. sibiricus*, n. sp. Type locality, Kantaika, in northern Siberia at 75° N, 105° E.). Specimen examined.

Hydroporus boreus Gordon 1981: 106. Holotype, in CASC labelled: Aklavik, NWT, July 28 1932, Bryant Lot 308/ HOLOTYPE, Hydroporus boreus, Robert Gordon (red label). Specimen examined.

Selected References. Sharp 1882*a*: 466; Zimmermann 1931: 26; Zaitzev 1953: 172.

Description. Length = 3.5 to 4.1 mm, width = 1.8 to 2.2 mm, length: width = 1.89 to 1.96. Body (Fig. 63A, B) ovate, widest behind middle, rather abruptly narrowed posteriorly; pronotum broad, lateral margin more arcuate than that of elytron therefore lateral outline of body discontinuous in dorsal aspect.

Color yellowish brown to reddish brown. Head dorsally brownish-yellow with poorly defined infuscate spot mesad to each eye, hind margin piceous; head ventrally brownish-yellow. Antenna yellow basally, outer antennomeres progressively infuscate apically; palpi yellow, apex of maxillary palpus infuscate or not. Pronotum brownish-yellow to rufous with poorly defined medial infuscation extending to base. Elytron reddish brown, medially darkened on most specimens; epipleuron yellow. Ventral surface and legs yellowish brown to reddish.

Head with sparse, small, deep punctures, more or less uniformly distributed except smaller medially on frons. Pronotum with small punctures medially, punctures larger, denser basally and apically, large and almost contiguous laterally. Elytron coarsely punctate, density of punctures various but on most specimens separated by slightly more than their own diameter, each bearing a fine, yellow setae about one and one half to two times as long as distance between punctures; epipleuron coarsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large, somewhat irregular in distribution, separated by about their own diameter, larger in size than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small but deep, separated basally and laterally but denser and more or less approximate medially.

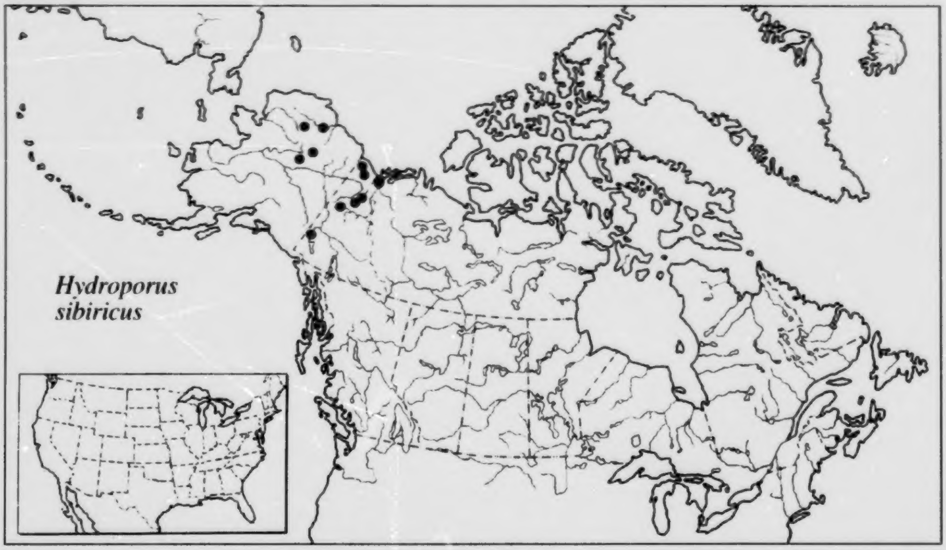
Microreticulation varying sexually; male with disc of pronotum and elytron shiny, reticulation absent or faint; metacoxal plate finely reticulate, abdominal sterna with reticulation obsolete; female with lines dense, dorsal surface dull; venter with lines shallower and less dense but evident.

Pronotum with lateral bead elevated, well defined and broad at least at mid-length; lateral margin in lateral aspect slightly reflexed upwards on anterolateral angle exposing proepipleuron; posterolateral angle produced, acute but narrowly rounded apically; basal margin of pronotum broadly concave each side of posteromedial lobe. Elytron with surface irregular, serial punctures in faint longitudinal depressions; lateral margin strongly ascendant to humeral angle in lateral aspect, epipleuron visible to shoulder. Prosternum with file distinct but with ridges weak, prominence low and obtuse in lateral aspect; blade strongly convex, narrow, narrowly rounded apically. Protibia with anterior face bearing a longitudinal row of punctures close to mesal margin, row coherent basally but punctures somewhat scattered over face apically. Metatibia arcuate, curved outwards at base in both sexes. Metacoxal processes conjointly with hind margin truncate to very slightly and broadly angulate.

Male protibia width = 0.18 mm, protarsal ratio = 0.80: 0.79: 0.70 (Fig. 63D); protarsomeres 1 and 2 with numerous small scales on ventral surface; protarsal claws (Fig. 63C) slightly modified, arcuate basally and more or less straight and evenly tapered in apical half. Aedeagus (Fig. 63E, F) in lateral aspect enlarged basally and thick, apex with a short ventral hook.

Ecology. Adult specimens have been collected from among emergent vegetation along the margin of small tundra pools and slow, silty bottomed streams.

Distribution. Map 83. The species occurs on the arctic mainland from the western Northwest Territories to Alaska as well as in northern Siberia.



Map 83. *Hydroporus sibiricus* Sahlberg. Canadian and Alaskan collection localities and United States state records.

Hydroporus obscurus-group
Figs. 64 – 67

Size small to moderate, length = 2.8 to 4.3 mm; head and pronotum of most specimens largely rufous, elytra reddish to piceous, ventral surface predominantly reddish with some dark markings or mainly black; body shape elongate, sides subparallel medially or with point of maximum width before middle and apex rather attenuate; elytron in lateral aspect with lateral margin more or less straight; metasternum with medial groove impressed.

This group contains six Nearctic and one Holarctic species. The members, with the exception of *H. badiellus*, are easily recognized by the extensive reddish color of the

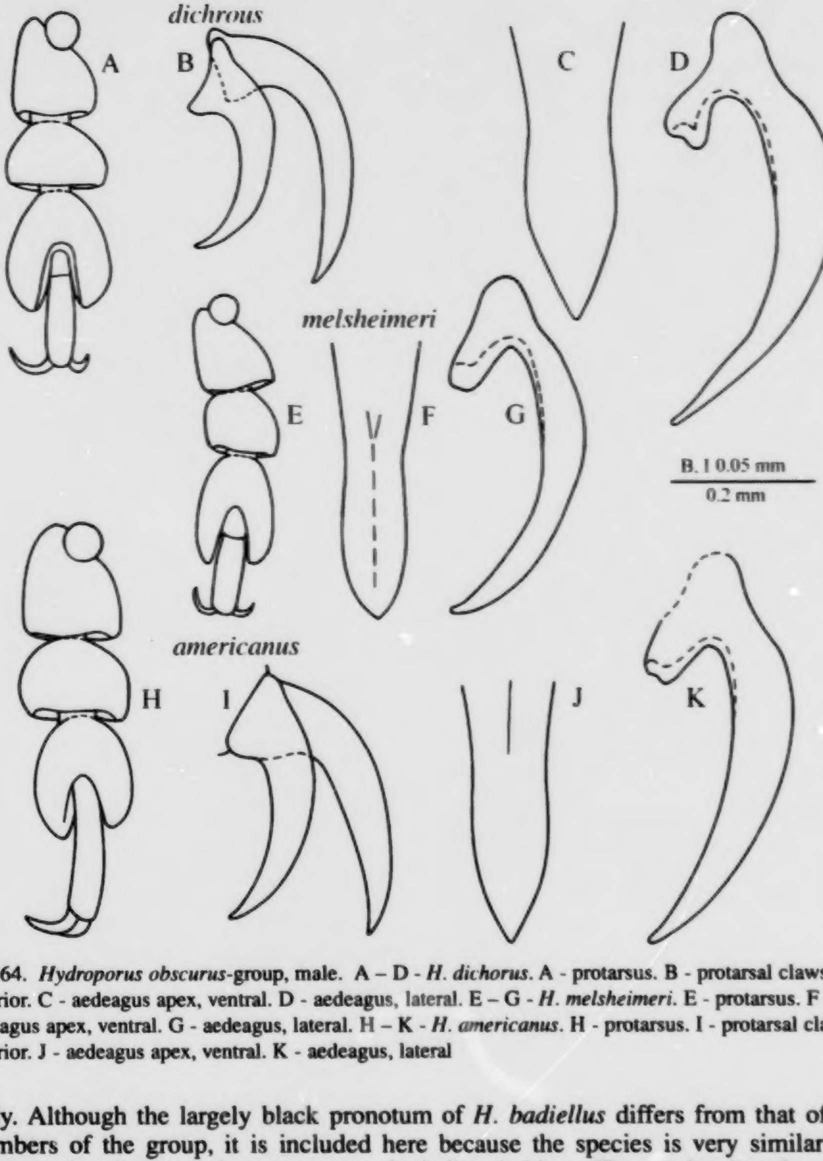


Fig. 64. *Hydroporus obscurus*-group, male. A – D - *H. dichorus*. A - protarsus. B - protarsal claws, anterior. C - aedeagus apex, ventral. D - aedeagus, lateral. E – G - *H. melsheimeri*. E - protarsus. F - aedeagus apex, ventral. G - aedeagus, lateral. H – K - *H. americanus*. H - protarsus. I - protarsal claws, anterior. J - aedeagus apex, ventral. K - aedeagus, lateral

body. Although the largely black pronotum of *H. badiellus* differs from that of other members of the group, it is included here because the species is very similar to *H. obscurus* in all other character states including habitus. The predominantly reddish venter and grooved metasternum of some species in this group resemble members of *Neoporus* but other features, such as shape of the metacoxal processes, argue against a close relationship. Most of the species occur in cool to cold water and are associated with peaty soils and mosses or dense emergent vegetation.

2. *Hydroporus dichrous* Melsheimer 1844

Fig. 64A – D

Hydroporus dichrous Melsheimer 1844: 28. Type locality - Pennsylvania. Type in MCZC, not examined.

Selected References. LeConte 1855: 292; Crotch 1873: 394; Sharp 1882*a*: 477; Wickham 1895: 76; Blatchley 1910: 220; Sherman 1913: 46; Fall 1923: 66; Young 1954: 82; Hilsenhoff 1995: 10.

Description. Length = 3.5 to 4.3 mm, width = 1.8 to 2.4 mm, length: width = 1.88 to 1.96. Body oval, widest at middle and more attenuate posteriorly than anteriorly; lateral outline continuous in dorsal aspect.

Color reddish. Head dorsally and ventrally reddish. Antenna yellow basally, antennomeres 5 to 11 piceous apically; palpi yellow, maxillary palpus and also labial palpus of some specimens with apex of apical palpomere infuscate. Pronotum with disc reddish (some specimens with head and pronotum medially darkened, brownish) contrasting with darker elytra; elytron reddish brown, paler at humeral angle and laterally; epipleuron reddish. Ventral surface and legs reddish to rufopiceous except metasternum and metacoxal plates piceous; some specimens also with sterna 1 and 2 and 3 to 6 anteromedially, piceous.

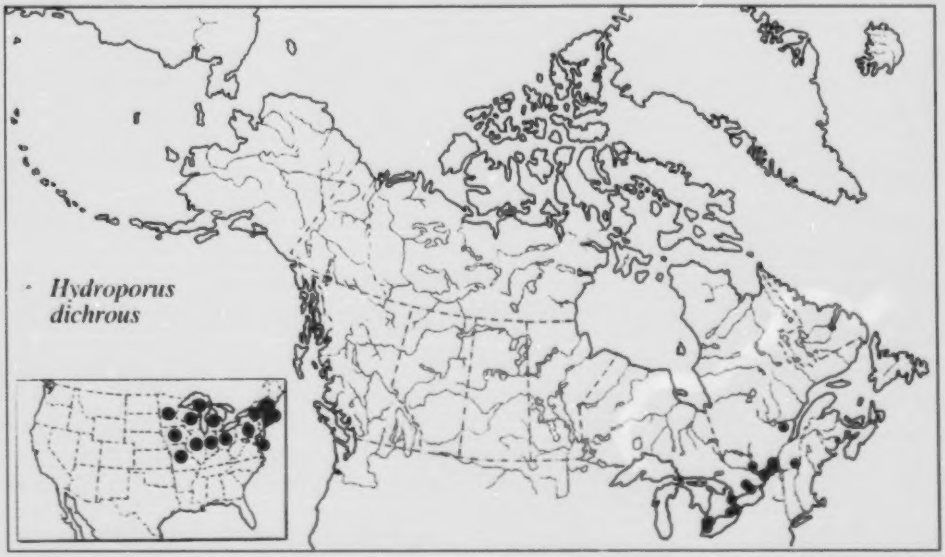
Head with small fairly evenly distributed punctures. Pronotum medially with punctures of irregular size and rather widely spaced, laterally and basally punctures larger and denser and somewhat longitudinally confluent on posterolateral angle. Elytron with punctures smaller than or subequal to those on base of pronotum, laterally punctures finer than medially on disc, punctures separated by about one to one and one half times their own diameters, each bearing a pale seta, seta about two times as long as distance between punctures; epipleuron with punctures small and shallow. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, punctures separated by about their own diameter, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures very fine and moderately dense. Microreticulation present over entire body but may be shallowly impressed on some males; some females with microsculpture dense and with evident iridescence on at least pronotum.

Pronotum with lateral bead complete but narrow; lateral margin in lateral aspect slightly reflexed upwards on anterolateral angle exposing epipleuron; posterolateral angle more or less right angled; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron disappearing well posterior to shoulder. Prosternum not modified; process with declivity well developed, file and prominence evident; blade elongate-ovate, bluntly pointed apically. Protibia with a single longitudinal row of punctures on anterior face. Metasternum with medial line impressed to form an elongate medial impression just posterior to flattened area receiving apex of prosternal process. Metacoxal processes conjointly with hind margin truncate.

Male protibia width = 0.16 mm, protarsal ratio = 0.79: 0.95: 0.91 (Fig. 64A); protarsomere 1 with two pairs and protarsomere 2 with one pair of oval scales on ventral surface; anterior protarsal claw (Fig. 64B) about two thirds length and broader than posterior. Aedeagus (Fig. 64C, D) broad in dorsal aspect, constricted medially, shortly pointed apically.

Ecology. Specimens have been collected from the margins of small ponds and very slow streams, from sites where emergent vegetation and plant debris are dense.

Distribution. Map 84. All Canadian records are from southern Quebec and Ontario; the range extends west to Minnesota and Missouri and south to at least New Jersey and Maryland. Young (1954) tentatively assigned a specimen from Columbia Co., Florida to this species.



Map 84. *Hydroporus dichrous* Melsheimer Canadian and Alaskan collection localities and United States state records.

3. *Hydroporus melsheimeri* Fall 1917
Fig. 64E – G

Hydroporus melsheimeri Fall 1917: 182. Type locality - Tyngsboro, Massachusetts. Type in MCZC, not examined.

Selected References. Fall 1923: 66; Hilsenhoff 1995: 11.

Description. Length = 3.2 to 3.6 mm, width = 1.7 to 2.0 mm, length: width = 1.75 to 1.87. Body rather oval, most specimens with pronotum strongly broadened from apex to base and point of maximum width of body within basal quarter of elytra and well anterad to middle of body especially in male.

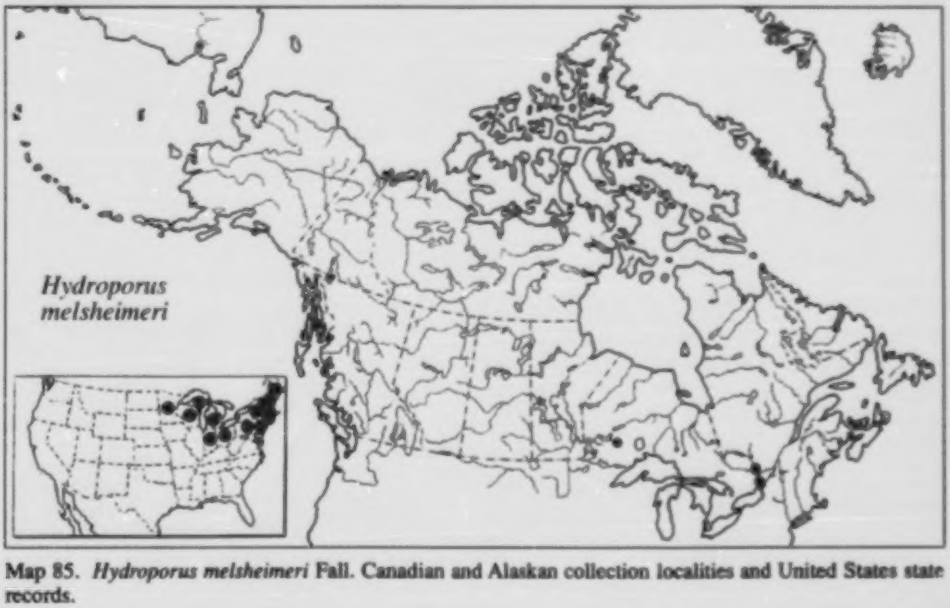
Color reddish. Head dorsally and ventrally reddish. Antenna pale basally, antennomeres 4 to 11 infuscate apically; palpi yellow except apex of maxillary palpus infuscate, labial palpus infuscate apically on not. Pronotum reddish, anterior and posterior margins piceous medially; elytron reddish brown medially, with base, lateral margin and apex paler, many specimens with a more or less distinct subapical pale spot which is continuous with lateral pale area; epipleuron reddish. Ventral surface reddish except abdominal sterna darker reddish, metasternum and metacoxal plate piceous. Legs reddish.

Head with fine, sparse punctures, punctures deeper and denser medially between eyes. Pronotum with irregularly sized, sparse punctures medially on disc; punctures larger, denser and almost confluent laterally and basally. Elytron with punctures fine but coarser than those on disc of pronotum, punctures separated by one to two times their own diameters, each bearing a seta longer than distance between punctures; epipleuron coarsely, densely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, punctures separated by about their own diameter, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small basally, larger and denser medioapically. Microreticulation present over entire body; some females with microsculpture more evident.

Pronotum with lateral bead distinct; lateral margin in lateral aspect slightly reflexed upwards on anterolateral angle narrowly exposing epipleuron; posterolateral angle slightly acute, basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron disappearing well posterior to shoulder. Prosternum not modified; process with declivity well developed, file and prominence evident; blade spatulate, relatively broad, widest distad of middle, apex broadly rounded; lateral bead broad on basal half. Protibia in anterior aspect with mesal margin more or less straight basally, slightly arcuate distally; anterior face with a single longitudinal row of punctures. Metasternum with a well developed medial longitudinal groove. Metacoxal processes conjointly with hind margin truncate or slightly produced medially.

Male protibia width = 0.18 mm, protarsal ratio = 0.78: 0.80: 0.73 (Fig. 64E); protarsomere 1 with two and protarsomere 2 with one pair of small scales on ventral surface; protarsal claws small and slender, anterior claw slightly shorter than posterior. Aedeagus (Fig. 64F, G) short, slightly constricted medially in dorsal aspect; apex bluntly pointed.

Ecology. Specimens were collected from the margins of small, permanent, partly exposed ponds within deciduous woodlands, where emergent vegetation and plant debris was dense. Hilsenhoff (1995) also records specimens from marshes, ditches and river sloughs.



Map 85. *Hydroporus melsheimeri* Fall. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 85. The range extends from southern Quebec and Ontario to New Jersey, Indiana and Minnesota.

4. *Hydroporus americanus* Aubé 1838
Fig. 64H – K

Hydroporus americanus Aubé 1838*b:* 575. Type locality - Boston, Massachusetts. Type material probably in IRHN. Type specimen not examined.

Selected References. Mannerheim 1853; 164. LeConte 1855; 292. Crotch 1873: 394; Sharp 1882*a*: 477; Wickham 1895: 76; Blatchley 1910: 113; Fall 1923: 67.

Description. Length = 3.6 to 4.0 mm, width = 1.7 to 2.0 mm, length: width = 1.89 to 2.02. Body elongate-oval, elytra distinctly parallel in basal half; lateral outline continuous in dorsal aspect.

Color reddish. Head dorsally and ventrally, mainly reddish. Antenna reddish with outer antennomeres infuscate apically; palpi yellow except apex of maxillary palpus infuscate. Pronotum uniformly reddish. Elytron reddish brown to piceous medially, paler laterally and apically; epipleuron reddish. Ventral surface and legs reddish to rufopiceous except abdominal sterna darker reddish, metasternum and metacoxal plates piceous.

Head with small and moderately dense punctures. Pronotal disc medially with punctures fine, separated by twice their diameters or more, laterally with punctures coarser and separated by about their own diameters, somewhat longitudinally confluent on posterolateral angle. Elytron with punctures moderate, subequal in size to basal pronotal punctures, separated by one to one and one half times their own diameters, each bearing a yellowish, inconspicuous seta longer than distance between punctures; epipleuron with punctures sparse, small and shallow. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, punctures separated by about one and one half times their own diameter, somewhat larger in size than those of abdominal sterna 1 and 2 laterally; sternum 6 finely, sparsely punctate. Microreticulation present over entire body, shallowly impressed on males, some females with microsculpture dense and body less shiny.

Pronotum with lateral bead distinct but fine; lateral margin in lateral aspect slightly reflexed upwards on anterolateral angle narrowly exposing epipleuron; posterolateral angle about right-angled; basal margin sinuate on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin straight, epipleuron disappearing posterior to shoulder. Prosternum not modified; process with declivity well developed, file and prominence evident; blade narrow, acutely ridged medially, narrowly rounded apically. Protibia with anterior face with a single longitudinal row of punctures. Metasternum with medial line broadly, shallowly impressed. Metacoxal processes conjointly with hind margin slightly and broadly angulate.

Male protibia width = 0.18 mm, protarsal ratio = 0.79: 0.89: 0.83 (Fig. 64H); protarsomere 1 with two pairs and protarsomere 2 with one pair of larger scales on ventral surface; protarsal claws (Fig. 64I) small, equal in length and unmodified. Aedeagus (Fig. 64J, K) in dorsal aspect slightly constricted in middle, tapering evenly to a point in apical third.

Ecology. Specimens were collected in New Jersey from small forest pools and from depositional areas of a small, slow stream flowing through deciduous forest. These sites had dense accumulations of fallen leaves among sedges growing on organic silt.

Distribution. This species has been collected infrequently and its range is poorly known. The species occurs along the Atlantic coast from Massachusetts to North Carolina, and also in Michigan and Illinois. Gordon (1969) tentatively assigned a female specimen from Antigonish, Nova Scotia (USNM) to this species. However, despite a search for this specimen in USNM we were unable to locate it. Because of the difficulty of separating female specimens of *H. americanus* and *H. dentellus* (a common species in Nova Scotia), we do not accept the Canadian record.

5. *Hydroporus dentellus* Fall 1917

Fig. 65.

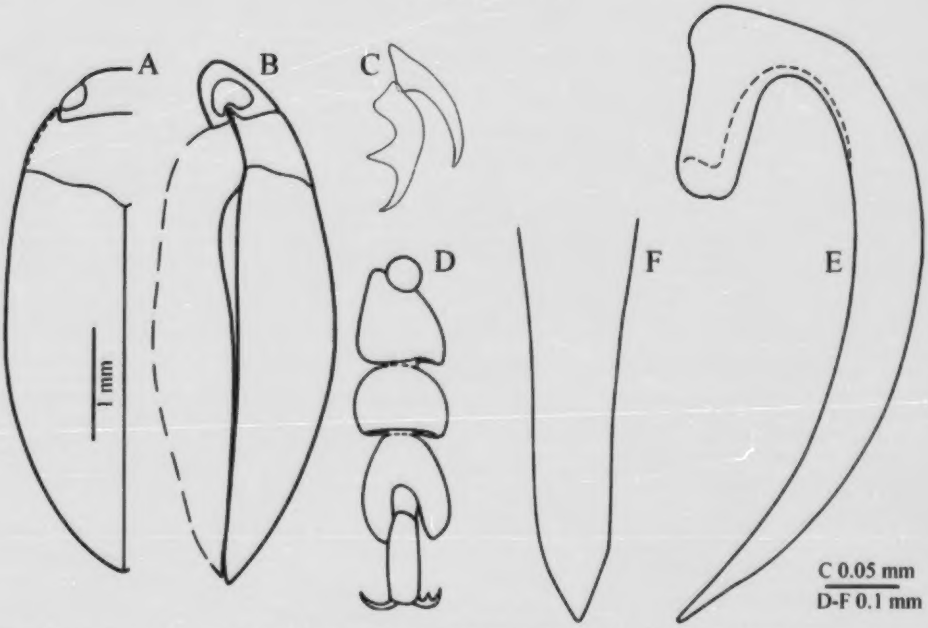


Fig. 65. *Hydroporus dentellus* Fall. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Hydroporus dentellus Fall 1917: 181. Holotype - male, Tyngsboro, Massachusetts, MCZC type 23928. Type examined.

Selected References. Fall 1923: 68; Hatch 1953: 206; Larson 1975: 295; Hilsenhoff 1995: 9.

Description. Length = 3.8 to 4.3 mm, width = 1.8 to 2.2 mm, length: width = 1.92 to 2.12. Body (Fig. 65A, B) elongate, elytra subparallel in basal half; lateral outline continuous in dorsal aspect.

Color reddish to piceous, most northern specimens darker. Head dorsally reddish with frons mesad to each eye and along posterior margin, darkened on many specimens; head ventrally reddish. Antenna pale basally, antennomeres 2 to 11 infuscate, at least apically; palpi reddish except apical palpomere of each palpus infuscate. Pronotum with disc reddish brown to rufopiceous, paler laterally with lateral margin and bead reddish; anterior margin darkened medially. Elytron dark brown or piceous medially and apically, paler reddish laterally; epipleuron red. Ventral surface mainly rufopiceous to black except head, prothorax, metacoxal process, sterna 2 and 3 medially, and sterna 3 to 6 apically and laterally, reddish. Legs reddish to rufopiceous.

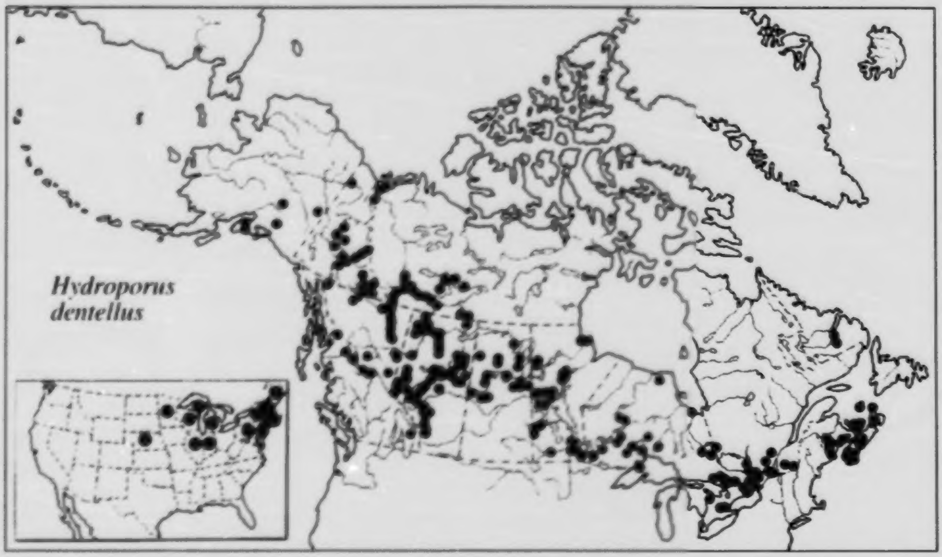
Head with small and moderately dense punctures. Pronotum with disc medially with sparse punctures of varied size, separated by about 2 times their diameter, punctures larger and denser towards margins, somewhat longitudinally confluent on posterolateral angle. Elytron coarsely and densely punctate, punctures subequal to or slightly smaller than those on base of pronotum, each puncture bearing a pale brown seta about one and one half times as long as distance between punctures; epipleuron finely but distinctly punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, punctures separated by about one and one half times their own diameter, equal to or slightly larger in size than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small, more or less evenly distributed over surface. Microreticulation evident over entire dorsal surface; male somewhat shiny with meshes open; some females with sculpture like that of male but most with lines very fine and dense and surface dull or faintly iridescent.

Pronotum with lateral bead narrow but well defined, lateral margin in lateral aspect not reflexed upward and not exposing epipleuron; posterolateral angle narrowly rounded, more or less right angled; basal margin sinuate on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin more or less straight but slightly sinuate near humeral angle, epipleuron disappearing well posterior to shoulder. Prosternum not modified, process with declivity well developed, file evident but prominence low and more or less obsolete; blade moderately broad, evenly elongate-oval, broadly convex medially, bluntly pointed apically; lateral bead not conspicuously broadened basally. Protibia with anterior face with a single row of punctures. Metasternum with medial line slightly impressed anteriorly, most strongly so just posterior of level of hind margin of mesocoxae. Metacoxal processes conjointly with hind margin slightly produced medially.

Male protibia width = 0.18 mm, protarsal ratio = 0.78: 0.92: 0.83 (Fig. 65D); protarsomere 1 with two pairs and protarsomere 2 with one pair of scales on ventral surface; anterior protarsal claw (Fig. 65C) with a large medioventral tooth. Aedeagus (Fig. 65E, F) elongate, sides sinuate in ventral aspect, apex shortly pointed.

Ecology. This species occurs in shallow water amongst dense vegetation. Larson (1975) recorded it from small peat pools in Alberta. It is commonly found in mats of moss. However, in eastern Canada it has a wider range of habitats, occurring in peatland pools as well as in densely vegetated forest or forest edge pools.

Distribution. Map 86. The range extends from the New England states to southeastern British Columbia, and north to the Mackenzie Delta and southern Alaska. This species is primarily boreal.



Map 86. *Hydroporus dentellus* Fall. Canadian and Alaskan collection localities and United States state records.

6. *Hydroporus obscurus* Sturm 1835

Fig. 66A – D

Hydroporus obscurus Sturm 1835: 65. Type locality - Berlin, Germany. Type series should be deposited in Zoological Museum München, Germany. Type not examined.

Hydroporus hockingi Larson 1975: 296. Holotype - male, labelled as follows: Alta., Tp. 37 Rge. 5 W 5 Mer., 13.v.1973, D. and M. Larson/ HOLOTYPE, *Hydroporus hockingi*, D. Larson 1975 (red label)/ Hydroporus hockingi Larson 1975, CNC No. 15030 (red label)/ *Hydroporus obscurus* Sturm det. A. Nilsson -'85. Synonymy proposed by Nilsson and Holmen (1995).

Selected References. Fall 1923: 88; Larson 1975: 296; Hilsenhoff 1995: 12; Nilsson and Holmen 1995: 51 – 52.

Description. Length = 2.8 to 3.3mm, width = 1.4 to 1.6 mm, length: width = 1.90 to 2.08. Body (Fig. 66A, B) form various, elongate oval to somewhat attenuate posteriorly; strongly convex dorsally, somewhat flattened ventrally; lateral outline continuous in dorsal aspect.

Color reddish to piceous. Head dorsally pale reddish with a slightly darkened area mesad of each eye; head ventrally reddish. Antenna pale with antennomeres 2 or 3 to 11 infuscate apically; maxillary palpus reddish with apical palpomere infuscate apically, labial palpus infuscate apically or not. Pronotum with disc dark reddish medially, anterior and posterior borders dark brown to piceous medially, lateral margins broadly reddish. Elytron reddish laterally and basally, darkened mesally and distally; epipleuron red. Ventral surface dark reddish to piceous except head, prothorax, abdominal sternum 2 medially, and sterna 3 to 6 posteriorly and laterally, reddish. Legs reddish.

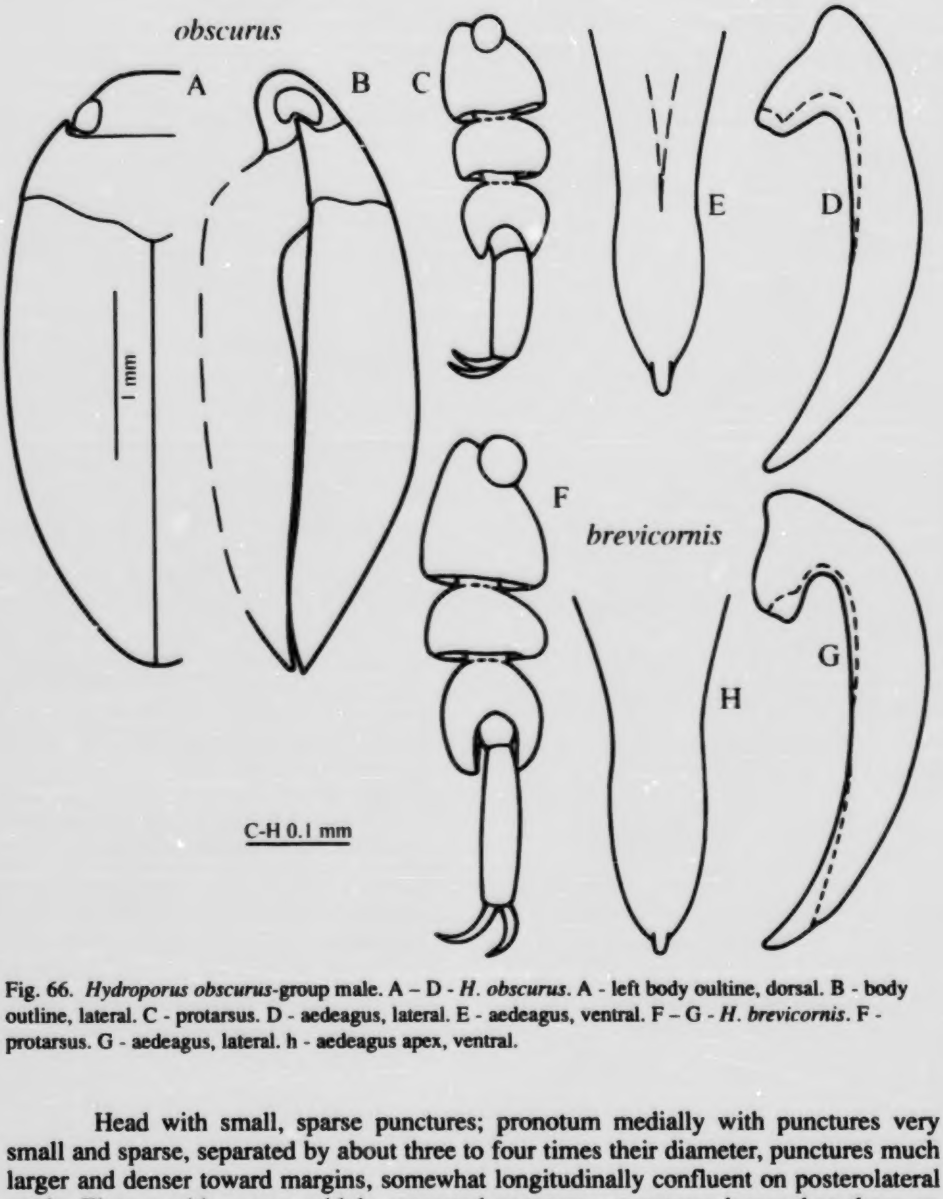


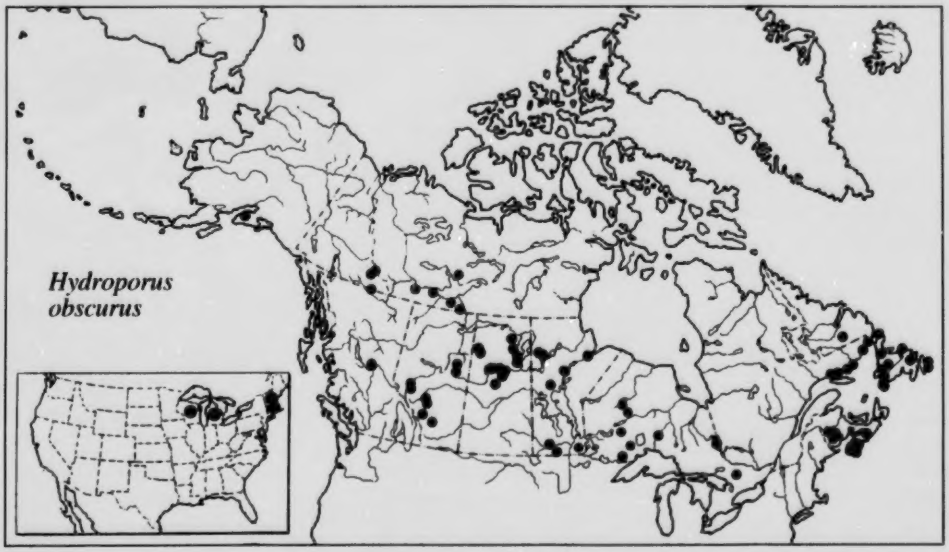
Fig. 66. *Hydroporus obscurus*-group male. A – D - *H. obscurus*. A - left body oultine, dorsal. B - body outline, lateral. C - protarsus. D - aedeagus, lateral. E - aedeagus, ventral. F – G - *H. brevicornis*. F - protarsus. G - aedeagus, lateral. h - aedeagus apex, ventral.

Head with small, sparse punctures; pronotum medially with punctures very small and sparse, separated by about three to four times their diameter, punctures much larger and denser toward margins, somewhat longitudinally confluent on posterolateral angle. Elytron with coarse, widely separated punctures, punctures larger than those on hind margin of pronotum and each puncture with a brown seta subequal in length to distance between punctures; epipleuron with large but shallow punctures. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate; metacoxal plate with punctures large and somewhat sparse, punctures separated by about one and one half to two times their own diameter, larger in size than those of abdominal sterna 1 and 2 laterally; sternum 6 finely and sparsely punctate. Body shiny but microreticulation evident over entire dorsal surface as distinct, well impressed meshes, similar on both sexes.

Antennomeres stout, 6 to 9 with length: width = 1.3 to 1.5. Pronotum with lateral bead narrow but distinct; lateral margin in lateral aspect straight to anterolateral margin, not exposing epipleuron; posterolateral angle more or less right angled; basal margin slightly sinuate on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin very slightly ascendant to humeral angle; epipleuron disappearing posterior to humeral angle. Prosternum not modified; process with declivity well developed, file evident but prominence obsolete or at most only slightly suggested; blade narrow, sharply pointed apically, angularly convex in cross section; lateral bead broad basally. Protibia in anterior aspect relatively broad, outer margin faintly concave, mesal margin more or less straight or slightly arcuate, anterior face with a single longitudinal row of punctures. Metasternum with median groove lightly impressed, most strongly so anteriorly. Metacoxal processes with hind margin shallowly sinuate mesad of lateral angles, slightly and bluntly angulate medially.

Male protibia width = 0.14 mm, protarsal ratio = 0.73: 0.63: 0.50 (Fig. 66C); protarsomere 1 with two pairs and protarsomere 2 with one pair of larger scales on ventral surface; protarsal claws not modified. Aedeagus (Fig. 66D, E) short and broad, in dorsal aspect constricted medially and with apex slightly produced; similar to that of *H. brevicornis* but slightly slenderer.

Comments. The use of the name *H. obscurus* has had a short and confused history in North America. Fall (1923) first recognized this species from North America based on a specimen from Michigan. He placed this species near *H. badiellus* which he did not associate with other species here assigned to the *H. obscurus*-group. Wallis (1973) considered *H. obscurus* to be synonymous with *H. badiellus*, however we recognize these two taxa as separate. Placement of the name *H. obscurus* near that of *H. badiellus* misled Larson (1975) who described *H. hockingi* and placed it near other members of the *H. obscurus*-group. Subsequent study of specimens from across North America and Europe indicates that this is a Holarctic species (Nilsson and Holmen 1995).



Map 87. *Hydroporus obscurus* Sturm. Canadian and Alaskan collection localities and United States state records.

Ecology. This species occurs in very small peatland pools, as well as in the moss mat along the margins of larger peatland pools and ponds. In Fennoscandia specimens also occur along the barren shores of oligotrophic lakes (Nilsson 1987*a*). Nilsson (1987*a*) described the mature larva based on European specimens and Alarie (1991) redescribed this stage based on Nearctic specimens.

Distribution. Map 87. The species is Holarctic. The Palaearctic range extends from Siberia to the British Isles. The North American range is from Newfoundland to Alaska in the boreal zone.

7. *Hydroporus brevicornis* Fall 1917

Fig. 66F – H

Hydroporus brevicornis Fall 1917: 180. Holotype, probably a female but not dissected, in MCZC labelled: Starr Lake, 4890 ft. NH/ (label upside down)/ TYPE *brevicornis*/ M.C.Z., Type 23917 (red label)/ H.C. Fall collection/ HOLOTYPE *Hydroporus brevicornis* Fall, 1923 (red label). Type examined.

Selected References. Fall 1923: 67; Balfour-Browne 1948: 160, 163; Young 1954: 81.

Description. Length = 3.3 to 3.9 mm, width = 1.7 to 1.9 mm, length: width = 1.91 to 2.02. Body elongate-oval, maximum width near middle of elytra; lateral outline continuous.

Color reddish to brownish. Head dorsally reddish except frons mesad to eyes and along posterior margin, darker red or brown; head ventrally reddish. Antenna yellow basally, outer antennomeres largely piceous; palpi yellow basally, apical palpomere of each palpus infuscate. Pronotum rufous laterally, darker brown to piceous medially but not black. Elytron reddish brown to piceous medially, paler laterally; epipleuron red. Ventral surface mainly piceous to black except prothorax reddish and abdomen with apical and lateral portions of sterna 3 to 6 reddish. Legs reddish.

Head with small, moderately dense punctures. Pronotum medially with punctures fine and sparse, separated by about three times their diameter, punctures larger and denser towards margins, somewhat longitudinally confluent on posterolateral angle. Elytron coarsely punctate, punctures larger than those on base of pronotum; each puncture bearing a pale brown seta about one to one and one half times as long as distance between punctures; epipleuron with punctures sparse, shallow and obscure. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, punctures separated by about one to one and one half times their own diameter, larger in size than those of abdominal sterna 1 and 2 laterally; sternum 6 very finely and sparsely punctate. Microreticulation evident over entire dorsal surface; sculpture similar in both sexes.

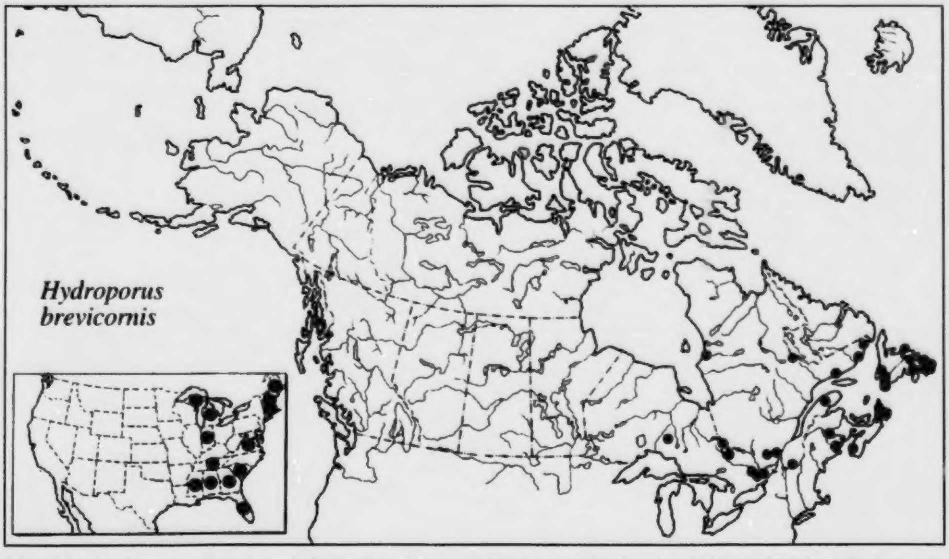
Antenna short, extending just to posterolateral angle of pronotum; distal antennomeres short and broad, middle antennomeres with length: width less than 1.5. Pronotum with lateral bead narrow but distinct; lateral margin in lateral aspect slightly curved upwards on anterolateral angle narrowly exposing epipleuron; in dorsal aspect lateral margin evenly arcuate and pronotum widest at hind angles; posterolateral angle right angled to acute; basal margin sinuate on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin straight or at most faintly sinuate near shoulder; epipleuron disappearing posterior to humeral angle. Prosternum not modified; process with declivity well developed, file and prominence well developed; blade narrow, acutely pointed apically and strongly convex; lateral bead broad basally. Protibia in anterior aspect broad, inner margin distinctly and smoothly arcuate, outer margin broadly and slightly concave; anterior face with a single longitudinal row of punctures. Metasternum with medial groove obsolete. Metacoxal processes conjointly with hind margin slightly and bluntly protruding medially.

Male protibia width = 0.17 mm, protarsal ratio = 0.71: 0.68: 0.60 (Fig. 66F); protarsomere 1 with two and protarsomere 2 with one pair of scales beneath; protarsal claws not modified. Aedeagus (Fig. 66G, H) short, broad, in ventral aspect constricted medially and with apex slightly produced.

Comments. The holotype is 3.85 mm in length, which is considerably longer than any other specimen we have seen (range 3.36 to 3.66 mm) although Fall (1923) reported a length of up to 4.0 mm. As no other differences were noted between the type and these smaller specimens, they are assumed to be conspecific.

Ecology. Specimens have been collected from small peatland pools of both fen and bog types. The beetles occur in moss or near moss along the pool margins. In Newfoundland the species is most common in barrens pools. Roughley and Larson (1991) commented on the north/south trend in habitat use by this species. Northern populations (south to about southern Indiana) occur in bogs and fens; specimens from the southern portion of the range are found exclusively in springs.

Distribution. Map 88. This species has a wide latitudinal distribution in eastern North America, extending from Newfoundland and Labrador to Florida, and west to Ontario and Michigan.



Map 88. ***Hydroporus brevicornis*** **Fall. Canadian and Alaskan collection localities and United States state records.**

8. *Hydroporus badiellus* Fall 1923

Fig. 67

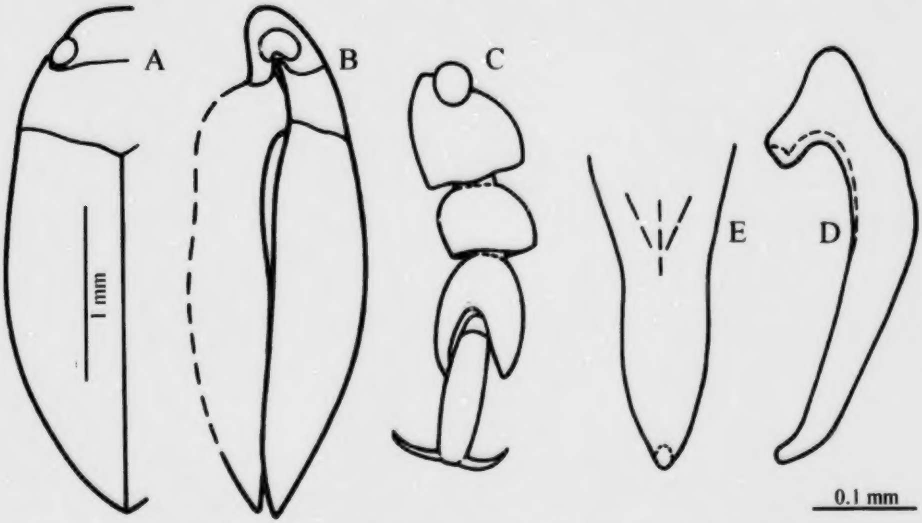


Fig. 67. *Hydroporus badiellus* Fall. A - left body outline, dorsal. B - body outline, lateral. C - male protarsus, dorsal. D - aedeagus, lateral. E - aedeagus apex, ventral.

Hydroporus badiellus Fall 1923: 89. Holotype, in MCZC, labelled: Marquette, 7/2-16 Mich./ / TYPE *badiellus*/ M.C.Z. type 23914/ H.C. FALL COLLECTION/ HOLOTYPE *Hydroporus badiellus* Fall. Type examined.

Selected References. Larson 1975: 307; Hilsenhoff 1995: 7, 9.

Description. Length = 2.6 to 3.0 mm, width = 1.2 to 1.5 mm, length: width = 2.03 to 2.20. Body (Fig. 67A, B) convex, elongate-oval and subparallel, widest at middle and attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown with pronotum black. Head dorsally dark reddish to piceous with anterior margin and a bar between eyes, reddish; head ventrally reddish, genae slightly darkened. Antenna reddish basally, antennomeres 5 to 11 darkened apically; maxillary palpus with apex of apical palpomere infuscate; labial palpus yellow or with slight apical infuscation. Pronotum piceous to black with front angle and lateral margin narrowly reddish to piceous. Elytron reddish to dark brown laterally, darker piceous medially and apically; epipleuron reddish. Ventral surface mainly piceous to black. Legs reddish to piceous.

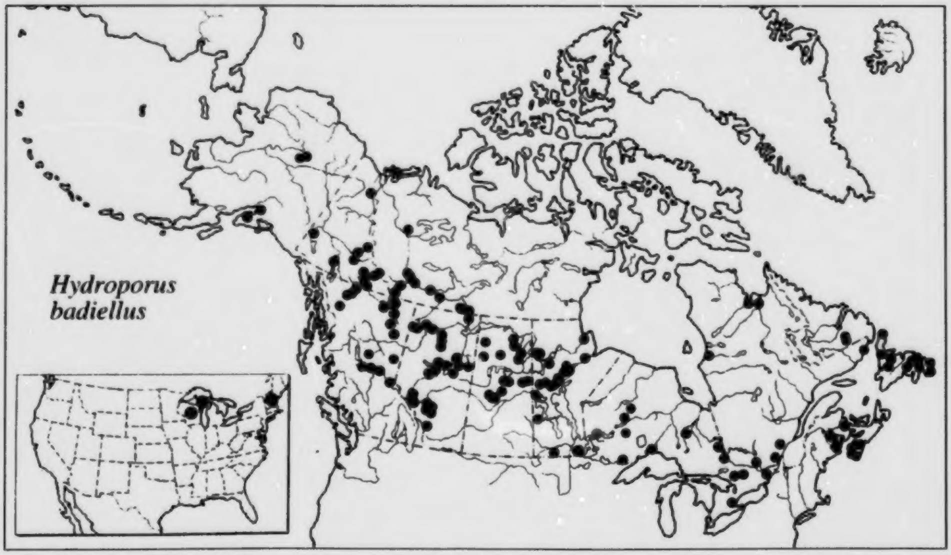
Head with small and relatively sparse punctures, punctures coarsest and more dense in chevron-shaped area beginning over antennal bases and converging at level of posterior margin of eyes. Pronotum medially with punctures very small, sparse and of irregular size, punctures much larger and denser anteriorly, laterally and posterolaterally, almost longitudinally confluent on posterolateral angle. Elytron with punctures small and subequal to those on base of pronotum, punctures separated by two to three times their own diameters, each bearing an inconspicuous dark seta generally shorter than distance between punctures; epipleuron with small, sparse punctures. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and sparse, separated by about two to three times their own diameter, equal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures fine and sparse. Microreticulation with lines of sculpture shallow, similar on both sexes.

Pronotum with lateral bead complete but narrow; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle more or less right angled; basal margin shallowly sinuate on each side of posteromedial lobe. Elytron with lateral margin only slightly and shortly ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, prominence obsolete or poorly developed and file well developed; blade narrow and elongate, acute apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin broadly and angularly protruding.

Male protibia width = 0.11 mm, protarsal ratio = 0.79: 0.77: 0.67 (Fig. 67C); protarsal claws not modified. Aedeagus (Fig. 67D, E) short, apex shortly and bluntly produced and ventrally curved in lateral aspect; in ventral aspect lateral margin of aedeagus sinuate.

Comments. This species differs from other members of the group by its dark color. However, in structural features it is very similar as indicated by Fall (1923) who noted *H. badiellus* to closely resemble *H. obscurus* Sturm. Wallis (1973) incorrectly considered these two names to be synonyms due to misinterpretation of *H. obscurus*.

Ecology. This species is constantly associated with moss, both *Sphagnum* as well as *Drepanocladus*. The beetles occur in small pools in moss mats or in saturated mosses along the margins of larger pools. The first and third instar larvae are described by Alarie (1991).



Map 89. ***Hydroporus badiellus*** **Fall. Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 89. This species is transcontinental in the boreal zone. It just reaches the southern limits of the low arctic.

Hydroporus notabilis-group
Fig. 68

Large, length = 4.0 to 5.4 mm. Body elongate oval, male more parallel-sided than female. Color mainly black. Dorsal surface finely and densely punctate with somewhat greenish, plumose (visible only at high magnification) pubescence. Pronotum in lateral aspect with lateral margin curved upwards and thickened on anterolateral angle. Elytra in lateral aspect ascending to humeral angle. Male protarsomeres 1 broadly dilated, ventrally bearing many small, rounded adhesive scales; protarsal claws elongate. Overwintering in egg stage.

This group contains a single variable Holarctic species. Angus (1985) discussed the position of the species within the Palaearctic fauna.

14. *Hydroporus notabilis* LeConte 1850
Fig. 68

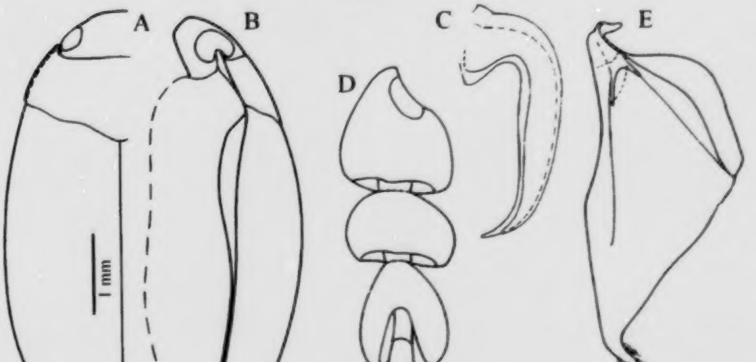


Fig. 68. *Hydroporus notabilis* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsal claws, anterior. D - protarsus. E - paramere. F — K - aedeagus, ventral and lateral.

Hydroporus notabilis LeConte 1850: 216. Holotype - in MCZC, pin with pale blue disc cut twice. Type locality given as Black Bay, Lake Superior, Ont.; MCZC type 6029. Type examined.

Hydroporus arcticus Thomson 1854 197 (type discussed by Angus 1985: 273).

Hydroporus niger; Anderson 1962: 62, not Say 1823: 103.

Selected References. Fall 1923: 72; Hatch 1953: 206; Anderson 1962: 62; Gordon and Post 1965: 17; Larson 1975: 294; Angus 1985: 273; Hilsenhoff 1995: 12; Nilsson and Holmen 1995: 58.

Description. Length = 4.0 to 5.4 mm, width = 2.0 to 2.9 mm, length: width = 1.79 to 2.10. Body (Fig. 68A, B) oval, male tending to be narrower than female and almost parallel-sided medially; female more evenly rounded laterally, widest at middle and attenuate posteriorly. Pronotum of male broad, lateral margin more arcuate than that of pronotum and therefore lateral outline of body discontinuous in dorsal aspect; pronotum of female narrower and lateral outline much less discontinuous.

Color black or some specimens brown with pronotum darker. Head dorsally reddish with a large spot mesad of each eye (spots broadly contiguous medially on most specimens) and posterior margin, piceous; head ventrally reddish to rufopiceous. Antenna testaceous to reddish, infuscate apically from antennomeres 3 or 4 to 11; palpi testaceous, each palpus with apical palpomere infuscate apically. Pronotum black with anterior angles and lateral margin narrowly reddish to piceous. Elytron piceous to black medially, lateral margins, and in some specimens basal margins, paler, dark reddish to piceous; epipleuron reddish. Ventral surface black except apex of metacoxal process, posterior margin of sterna 3 to 5, and apical half of sternum 6, reddish. Legs reddish to rufopiceous.

Head with punctures small and dense, punctures smaller and sparse on vertex and on clypeus. Pronotum medially with punctures fine and dense and of various sizes, punctures larger and denser posteriorly and somewhat transversely confluent on posterolateral angle. Elytron with punctures very fine and dense, smaller than those on disc of pronotum, punctures separated by about two times their diameter, each bearing a long greenish seta, seta two times longer than distance between punctures; epipleuron very finely, sparsely punctate. Metasternum laterally and sterna 1 and 2 laterally coarsely punctate, punctures on metacoxal plate smaller, shallower and more widely spaced, separated by about two times their own diameter; sternum 6 with small evenly spaced punctures. Microreticulation of male shallow, meshes open, dorsum rather shiny; female with elytron dulled by extremely fine, dense sculpture.

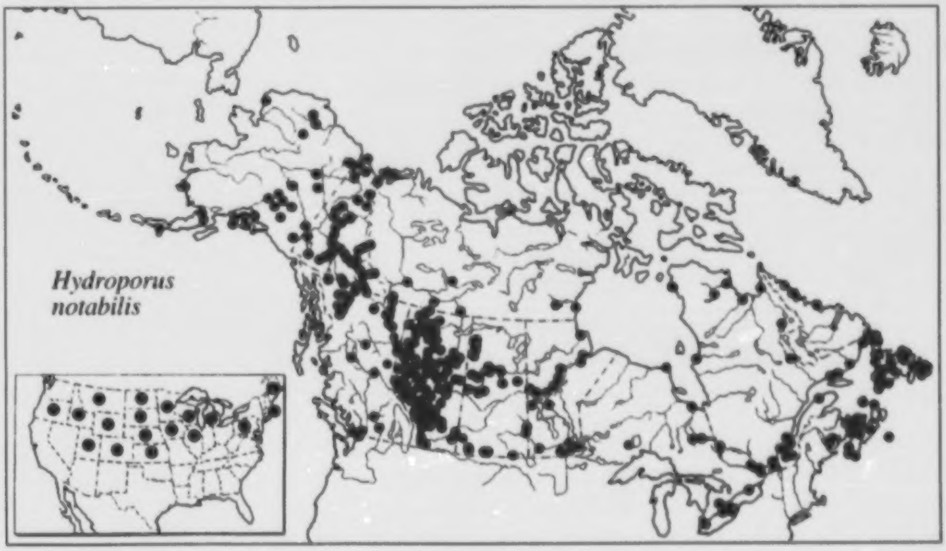
Pronotum with lateral bead narrow but well defined on basal three quarters of length, extended onto anterolateral angle where it is distinctly expanded in dorsal aspect; lateral margin in lateral aspect reflexed upwards near anterolateral angle exposing much of epipleuron and making anterolateral portion of dorsal disc more or less flat; posterolateral angle of male broadly rounded, that of female obtuse; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, prominence and file well developed; blade narrow and elongate, bluntly pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate or slightly angulate medially.

Male protibia width = 0.23 mm, protarsomeres broad (Fig. 68D), protarsal ratio = 1.04: 1.00: 0.81; tarsomeres 1 and 2 each bearing numerous small, rounded adhesive scales beneath; protarsal claws (Fig. 68C) elongate, strongly bent at base, more or less straight medially and shortly arcuate at apex. Aedeagus (Fig. 68F – K) simple, slender, in both lateral and ventral aspects narrowing more or less evenly to narrowly rounded apex.

Comments. This species varies in length and in body shape. Fall (1923) suggested that *H. arcticus* Thomson is likely a small arctic form of *H. notabilis*, and Angus (1985) confirmed the synonymy although he proposed retaining *H. arcticus* as a subspecies of *H. notabilis*. Northern specimens are smaller than southern specimens, but this variation is clinal with no obvious line of demarcation between two subspecies (see measurements below). *Hydroporus arcticus* is probably an ecotypic form of *H. notabilis* and as such should be treated as a synonym.

Variation in total length (mm) in selected North American population samples of *H. notabilis* is:

Locality	***n***	**range**	**mean**
Yukon Territory, Firth R.	7	4.22 – 4.51	4.35
Northwest Territories, Mackenzie Delta	18	4.18 – 4.74	4.47
Northwest Territories, Eskimo Point	5	4.00 – 4.29	4.09
Northwest Territories, Ft. Smith	14	4.85 – 5.44	5.02
Alberta, pooled	30	4.56 – 5.44	4.99
Manitoba, Churchill	20	4.18 – 5.22	4.56
Quebec, Bradore Bay	20	4.11 – 5.18	4.67
Newfoundland, pooled	30	4.37 – 5.22	4.85



Map 90. *Hydroporus notabilis* LeConte. Canadian and Alaskan collection localities and United States state records.

Male and female specimens differ in body form, with females on average being broader and more oval in outline in dorsal aspect. The mean value for length: width is greater for males than females in all population samples but the difference is statistically significant ($p = 0.01$) in only a few populations. Males vary in the width of the aedeagus but variation within a population may be as great as differences observed between widely separated populations (Fig 68F, H, J).

Ecology. This species occurs in small pools such as peat pools which are barren of vegetation or have sparse emergent sedges. Unlike all other North American species of *Hydroporus*, *H. notabilis* overwinters in the egg stage and in Canada and Scandinavia adults are present only from late spring to fall. However, Hilsenhoff (1995) claims adults overwinter in Wisconsin and fly to breeding sites in the spring.

Distribution. Map 90. The aggregate range is Holarctic. The Nearctic distribution extends from Newfoundland to Alaska in both the low arctic and boreal zones.

Hydroporus niger-group

Figs. 62; 69 – 71

Small to large size, length = 3.3 to 5.5 mm; body rather broadly oval, lateral outline continuous; color dark but with at least head relatively pale; punctation of dorsal surface relatively fine and dense; pronotum with basal margin strongly sinuate and posterolateral angle produced and acute, lateral margin not reflexed upwards on anterolateral angle; elytron with lateral margin more or less straight in lateral aspect; male protarsomeres broad, protarsomere 1 with two pairs of larger adhesive scales beneath, protarsal claws distinctly modified, strongly bent basally and sinuate ventrally; aedeagus in ventral aspect rather broad, subparallel to constricted medially, with a small apical projection.

All members of this group are Nearctic. One species, *H. signatus*, is transcontinental whereas the other species are eastern with their distributions centred in the eastern deciduous forest region.

10. *Hydroporus niger* Say 1823

Fig. 69

Hydroporus niger Say 1823: 103. Say's type lost. Because there has been some confusion about the use of the name *H. niger* Say (Sharp 1882*a*: 478, 973; Young 1953*a*: 116) and some older names are without type specimens, it is desirable to designate a neotype of this common species. Gordon (1969: 109) selected a neotype of *H. niger* but as his dissertation is not officially published (ICZN 1985 Art. 9) this designation is unavailable. To promote stability we designate the specimen chosen by Gordon as neotype. **NEOTYPE**, here designated, in USNM labelled: Pa. Colebrook, Lebanon Co. nr. Mt. Gretna, VIII-10-1951, P. J. S[pangler]/ LECTOTYPE, *Hydroporus niger* Say, 1823 design. Larson and Roughley (red label).

Hydroporus modestus Aubé 1838*b*: 576. Type locality North America. Type presumably in IRHN, not examined.

Hydroporus latifrons Sharp 1882*a*: 478. Type locality given as North America. Type not examined, synonymy given by Leech 1948: 92.

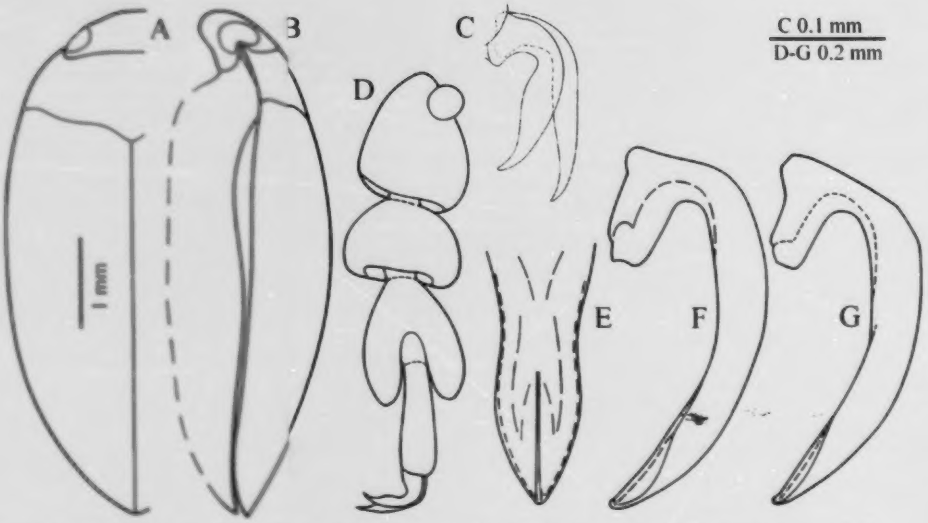


Fig. 69. *Hydroporus niger* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsal claws. D - protarsus. E - aedeagus apex, ventral. F – G - aedeagus, lateral.

Selected References. Blatchley 1910: 220; Fall 1923: 70; Leech 1948*a*: 92; Young 1954: 82; Hilsenhoff 1995: 11 – 12.

Description. Length = 4.2 to 5.0 mm, width = 2.1 to 2.6 mm, length: width = 1.89 to 2.03. A moderately large, broad species (Fig. 69A, B), body oval, widest at middle and rounded posteriorly; lateral outline continuous in dorsal aspect.

Color mainly black. Head dorsally red with hind margin and a large spot mesad to each eye, brown, spots on most specimens separate and not contacting dark hind margin; head ventrally reddish; antenna infuscate from antennomere 5 to 11; palpi infuscate apically. Pronotum rufopiceous to black with lateral margins broadly reddish; elytron piceous, lateral and humeral margins reddish; epipleuron reddish. Ventral surface mainly black with red spots on lateral portions of sterna 3 to 5 and apex of 6. Legs reddish.

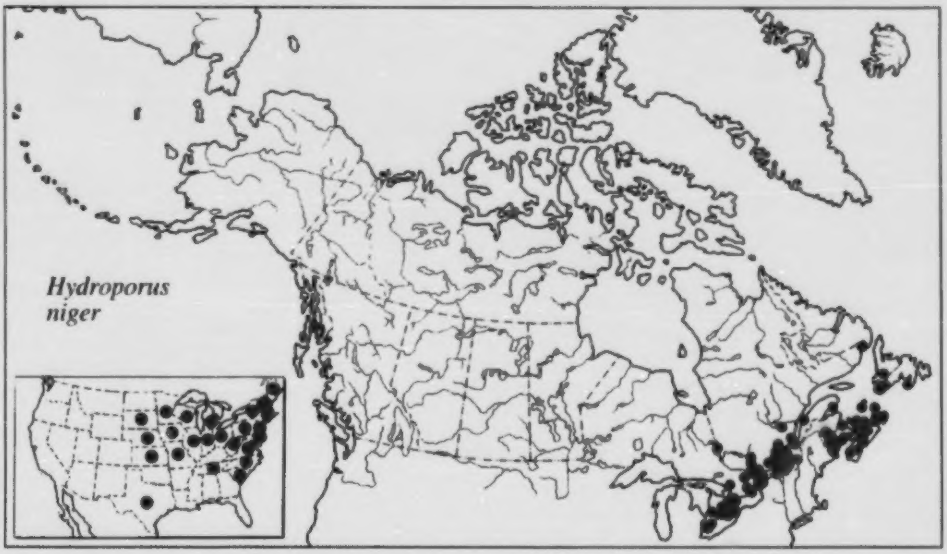
Head with fine, dense and uniform punctures. Pronotum punctate over entire surface, medially punctures dense and of various sizes; punctures somewhat longitudinally confluent on posterolateral angle. Elytron with punctures fine and smaller than those of disc of pronotum, punctures separated by about their own diameter, each bearing a greenish seta, seta about two to three times as long as distance between punctures; epipleuron finely and sparsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally moderately coarsely punctate, punctures coarsest on metasternum laterally and gradually becoming smaller posteriorly to sternum 3; metacoxal plate with punctures moderate and sparse, punctures separated by about two times their own diameter; sternum 6 with punctures small and evenly spaced. Microreticulation of male lightly impressed, surface shiny; female with sculpture denser, surface dull and punctation finer than that of male.

Pronotum with lateral bead narrow but distinct; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle acute; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight or very slightly sinuate in lateral aspect, epipleuron disappearing well posterior to shoulder. Prosternum depressed anteriorly but raised laterally anterad of procoxal cavities; process with declivity well developed, prominence and file very well developed; blade narrow and elongate with median ridge high and rounded, bluntly pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male protibia width = 0.19 mm, protarsal ratio = 0.95: 1.00: 0.86 (Fig. 69D); both protarsal claws modified (Fig. 69 C); anterior claw slightly shorter than posterior, broader and sinuate ventrally; posterior claw narrower and more elongate. Aedeagus (Fig. 69E – G) with a lateral subapical ridge on each side, ventral midline ridged at apex.

Ecology. These insects occur among emergent vegetation along the margins of exposed, sun-warmed ponds. All larval instars have been described by Alarie (1991).

Distribution. Map 91. The range extends from Newfoundland to Ontario and South Dakota, and south to South Carolina and Texas. Young (1954: 82) recorded a single male specimen from Florida but it likely belongs to one of the other species of the group.



Map 91. *Hydroporus niger* Say. Canadian and Alaskan collection localities and United States state records.

11. *Hydroporus falli* Blatchley 1925

Hydrororus falli Blatchley 1925: 162. Holotype - female in Purdue University, Lafayette, Indiana, with the following information: Dunedin, Pinellas County, Florida. Apr. 2, 1923 W.S. Blatchley. Holotype examined by Young (1953*a*) and not re-examined by us.

Selected References. Young 1953*a*: 116; Young 1954: 83.

Description. Length = 4.2 to 4.6 mm, width = 2.3 to 2.6 mm, length: width = 1.78 to 1.87. Body oval, widest at middle and rounded posteriorly; lateral outline continuous in dorsal aspect.

Color mainly black. Head dorsally reddish with a dark triangular spot mesad to each eye; ventral surface reddish; antenna reddish, distal antennomeres infuscate; palpi reddish. Pronotum black medially, lateral margins piceous. Elytron piceous to black; epipleuron dark reddish to piceous. Ventral surface mainly black. Legs reddish.

Head with small, dense punctures. Pronotum punctate over entire disc, medially punctures of moderate size and dense; punctures dense but not longitudinally confluent on posterolateral angle. Elytron with punctures about equal in size to those on disc of pronotum, separated by one half to one times their own diameters, each bearing a greenish seta, seta longer than three times distance between punctures; epipleuron coarsely and densely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, separated by about their own diameter, larger in size than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures fine, sparse and uniformly distributed. Male microreticulation shallowly impressed, surface shiny; female with meshes dense and strongly impressed, surface matte.

Pronotum with lateral bead complete and quite broad, at mid-length subequal to width of median antennomere; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle acute; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, prominence and file well developed; blade broad, bluntly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin angularly protruding.

Male protibia width = 0.16 mm, protarsomeres 1 to 3 broadly dilated, protarsal ratio = 0.94: 1.13: 1.00; anterior protarsal claw shorter than posterior, strongly arcuate at base and slightly sinuate on inner margin. Aedeagus in dorsal aspect narrow at middle, bulbous apically, narrowing to a blunt, downwardly curved tip.

Ecology. Young (1954) stated the species was fairly abundant in open marshes and ponds in Alachua Co., Florida.

Distribution. The species occurs only in Florida, Alabama and Georgia.

12. *Hydroporus ruficeps* Aubé 1838

Fig. 70B – D

Hydroporus ruficeps Aubé 1838*b*: 574. Type locality - United States, type reported to be deposited in IRHN. Type not examined.

Selected References. Sharp 1882*a*: 479; Fall 1923: 75; Young 1954: 82.

Description. Length = 4.8 to 5.5 mm, width = 2.5 to 2.8 mm, length: width = 1.88 to 1.96. Similar to *H. niger*. Body oval, widest at middle and attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color dark rufous to piceous. Head dorsally entirely reddish except for a darker area mesad to each eye on some specimens; head ventrally reddish; antenna reddish basally, outer antennomeres darkened; palpi reddish, maxillary palpus infuscate apically.

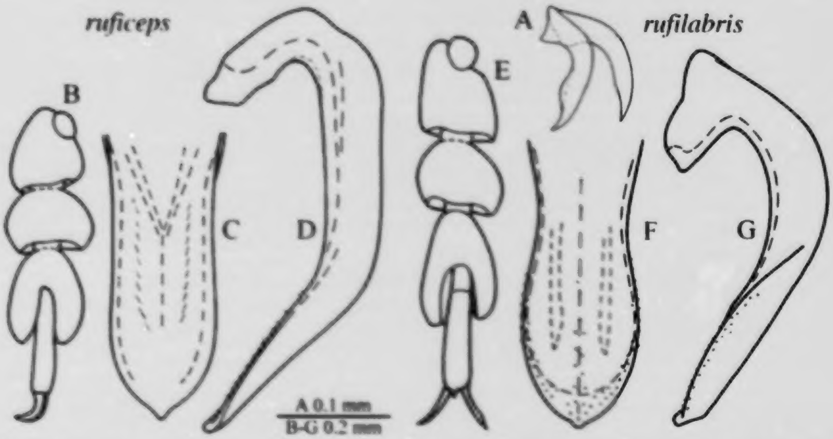


Fig. 70. *Hydroporus niger*-group, male. B – D - *H. ruficeps*. B - protarsus. C - aedeagus apex, ventral. D - aedeagus, lateral. A,E – G - *H. rufilabris*. A - protarsal claws, anterior. E - protarsus. F - aedeagus apex, ventral. G - aedeagus, lateral.

Pronotum piceous medially, broadly reddish laterally. Elytron piceous, humeral angle and lateral margin slightly paler; epipleuron reddish. Ventral surface largely black, abdomen with lateral margins of sterna 1 to 5 and most of sternum 6, reddish. Legs reddish.

Head with small, relatively sparse uniform punctures. Pronotum punctate over entire disc, medially punctures smaller, sparser and of various size; punctures denser but not confluent on posterolateral angle. Elytron with punctures fine, about equal to those on disc of pronotum, punctures separated by about one half to one times their own diameter, each bearing a greenish seta, seta two to three times longer than distance between punctures; epipleuron coarsely and moderately densely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and dense, separated by about two times their own diameter, equal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures fine, sparse and uniform. Microreticulation of male lightly impressed, dorsal surface shiny; most females with sculpture denser and surface dull.

Pronotum with lateral bead complete and of moderate width; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle acute; basal margin shallowly sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified, raised laterally and anteriorly with medial depression at base of process distinct; process with declivity well developed, prominence and file well developed; blade narrow and elongate, bluntly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal processes conjointly with hind margin truncate.

Male protibia width = 0.21 mm, protarsomeres 1 to 3 moderately dilated (Fig. 70B), tarsomere 2 broadest, protarsal ratio = 0.89: 1.00: 0.89; protarsal claws subequal in length, both strongly arcuate basally, anterior claw strongly sinuate on inner margin.

Aedeagus (Fig. 70C, D) in dorsal aspect with sides nearly straight to apex; apex nearly flat with a blunt median projection.

Ecology. The habitat has not been described but the species is probably lentic like other members of the group.

Distribution. This species occurs along the Atlantic Coast, from Massachusetts to Florida.

13. *Hydroporus rufilabris* Sharp 1882

Fig. 70A, E – G

Hydroporus rufilabris Sharp 1882*a*: 479. Type locality - described from Texas (Fall 1923: 78). Type in BMNH, not examined.

Hydroporus somnus Fall 1923: 77. Holotype - in MCZC labelled: Wis. (= Wisconsin)/ TYPE *somnus*/ MCZC Type 23956 (red label)/ H.C. Fall COLLECTION/ HOLOTYPE *Hydroporus somnus* Fall 1923 (red label). Type examined. NEW SYNONYMY.

Selected References. Fall 1923: 77; Leech 1948: 92 – 96.

Description. Length = 4.0 to 4.7 mm, width = 2.0 to 2.5 mm, length: width = 1.88 to 2.00. Similar to *H. niger*. Body oval, widest at middle, and rounded posteriorly; lateral outline continuous in dorsal aspect.

Color dark reddish-brown to rufopiceous. Head dorsally yellow-brown to rufous with hind margin and a large spot mesad to each eye piceous, on many specimens these spots large and contiguous across middle of frons; head ventrally reddish; antenna reddish basally, antennomeres 5 to 11 darkened apically; palpi reddish, maxillary palpus with apex of apical palpomere infuscate. Pronotum dark reddish to black medially, broadly paler laterally. Elytron rufopiceous to piceous, humeral area and apex faintly paler; epipleuron red. Ventral surface of body mainly black with sterna 3 to 6 pale laterally. Legs reddish.

Head with small, dense and uniform punctures. Pronotum punctate over entire disc, medially punctures small, moderately dense; punctures larger and somewhat contiguous on posterolateral angle. Elytron with punctures fine but coarser than those on disc of pronotum, separated by about one half to one times their own diameter, each bearing a greenish seta, seta about two to three times as long as distance between punctures; epipleuron coarsely and densely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures much coarser on metasternum than metacoxal plate or sterna; metacoxal plate with punctures large and dense, separated by about their own diameter, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small, somewhat denser medioapically. Microreticulation present but lightly impressed, surface shiny on both sexes.

Pronotum with lateral bead complete, of moderate width, not broadened anteriorly or medially; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle acute; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, prominence and file well developed; blade elongate-oval, strongly convex medially, bluntly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male protibia width = 0.17 mm, protarsus relatively narrow (Fig. 70E), protarsal ratio = 0.70: 0.75: 0.70; protarsomere 1 with two pairs, protarsomere 2 with one pair of oval scales on ventral surface; protarsal claws (Fig. 70A) subequal in length, anterior claw abruptly bent, ventral margin sinuate and obliquely narrowed to apex. Aedeagus (Fig. 70F, G) in dorsal aspect sharply constricted at middle; apex with a small projection and a longitudinal ventral carina.

Comments. We credit Gordon (unpublished Ph.D. thesis, pp. 124 – 125) for the above synonymy. He writes: "Dissection of genitalia of the male type of *somnus* Fall proved it to be identical with *rufilabris* The male protarsal claws are also identical. The type series of *somnus* is from Wisconsin and all [northern] specimens are larger [and distinctly more pubescent] than southern specimens of *rufilabris*. When Fall described *somnus* the only specimens of *rufilabris* he had seen were from Texas and without specimens from intermediate localities the size difference is very noticeable." In spite of the type specimen of *H. somnus* being labelled "Wis.", Wm. Hilsenhoff (*in lit.*) doubts that the species occurs in the state as he has not collected it and the only records he has seen are several specimens in the William Marshall collection (early 1900's) "labelled Wis that undoubtably did not come from Wisconsin".

Ecology. These beetles occur in detritus and emergent vegetation in shaded areas along the margins of small pools and ponds.

Distribution. The range extends from Ohio and Michigan to the Gulf Coast in Texas.

14. *Hydroporus signatus* Mannerheim 1853

Figs. 62; 71

Hydroporus signatus Mannerheim 1853: 161. Type locality given as Kadjak, Alaska. Type probably deposited in UMHF (see Comments). Type not examined.

Hydroporus inornatus Sharp 1882*a*: 478. Type - male, from Massachusetts, deposited in BMNH. Type not examined.

Hydroporus niger; Sharp 1882*a* 478 not Say 1823.

Hydroporus signatus youngi Gordon 1981: 110 - 113. Holotype - male, from Beltsville, Maryland deposited in USNM. Type not examined.

Selected References. Crotch 1873: 394; Wickham 1895: 76; Fall 1923: 87, 128; Leech 1948a: 95; Hatch 1953: 208; Larson 1975: 298; Gordon 1981: 110 – 113; Hilsenhoff 1995: 13, 14.

Description. Length = 3.3 to 4.0 mm, width = 1.8 to 2.2 mm, length: width = 1.85 to 2.04. Body oval (Figs. 62; 71A, B), somewhat depressed, males generally narrower with point of maximum width slightly more anterad than females, and more attenuate posteriorly; lateral outline continuous in dorsal aspect.

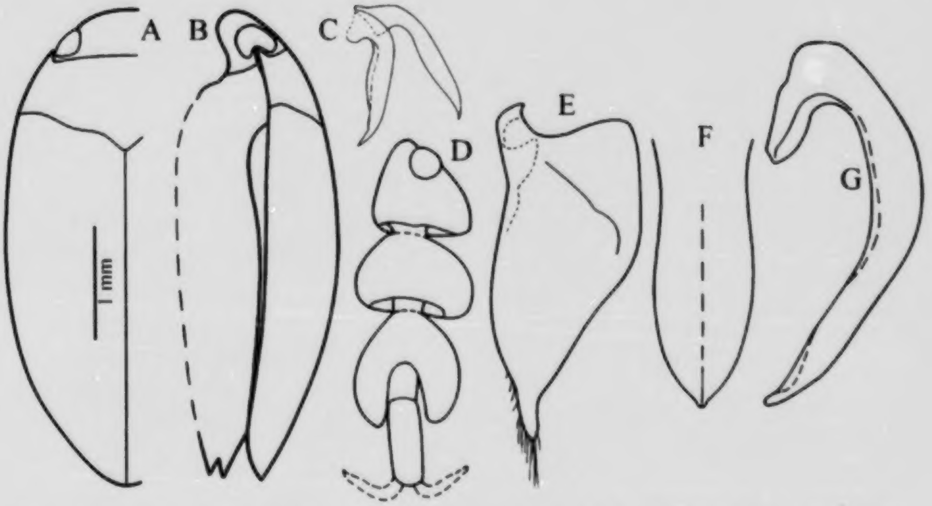


Fig. 71. *Hydroporus signatus* male. A - left body outline, dorsal. B - body outline, lateral. C - protasal claws, anterior. D - protarsus. E - paramere. F - aedeagus apex, ventral. G - aedeagus, lateral.

Color dark reddish brown to piceous, many specimens distinctly maculate (Fig. 62). Head dorsally brown to piceous with anterior margin and a transverse bar between hind margins of eyes reddish; head ventrally mainly reddish; antenna yellow basally, antennomeres 4 or 5 to 11 infuscate apically; palpi pale with apical palpomere of each palpus infuscate apically. Pronotum rufopiceous to piceous (seldom black) except anterolateral angle and lateral margin reddish. Elytron various, typically disc piceous with pale maculations as follows; along basolateral margin, an oblique humeral vitta, a subbasal lateral spot, a postmedial lateral spot and a subapical spot; pattern variously modified, some specimens with disc entirely piceous except for a small pale area on shoulder and along basolateral margin; infrequently specimen with entire disc yellowish brown; epipleuron red or brown. Ventral surface mainly black, except prosternal process, metacoxal processes apically, sterna 3 to 5 apically and laterally, and sternum 6 apically, red. Legs reddish with tarsi, tibia along outer margin, and base of metafemur, infuscate on most specimens.

Head with small but relatively dense punctures. Pronotum punctate over entire disc, medially punctures smaller, sparser and of irregular size; punctures larger along lateral and basal margins. Elytron with punctures fine, somewhat smaller than those on disc of pronotum, punctures separated by about two to three times their own diameter, each bearing a greenish seta, seta two times longer than distance between punctures; epipleuron shallowly and sparsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally moderately coarsely punctate, punctures of similar size and density throughout but shallowest on metacoxal plates. Sternum 6 with punctures coarse, dense and uniform. Microreticulation evident over entire surface but some males with lines very shallow on disc of pronotum and elytron, body shiny; ventral surface of many males with lines shallow and not forming coherent reticulation; many females with lines dense and surface matte.

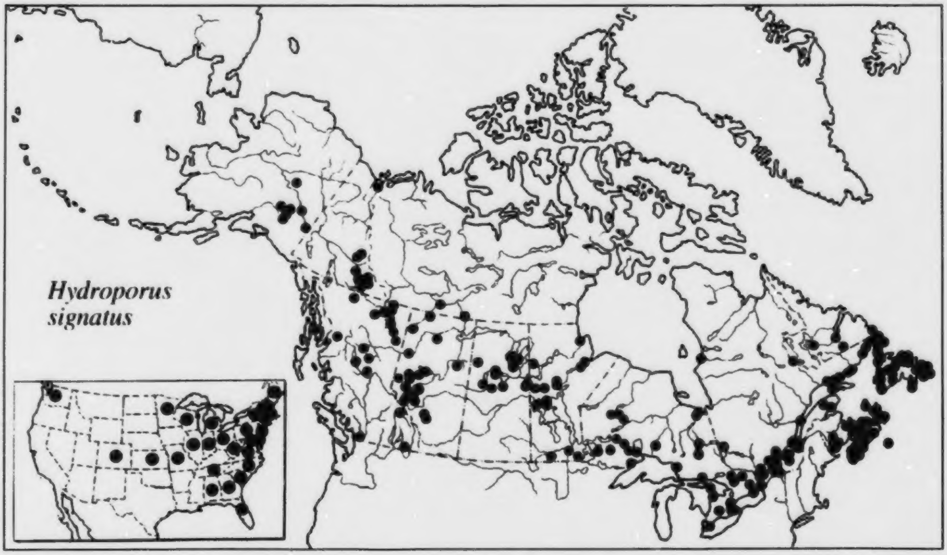
Pronotum with lateral bead complete but narrow; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle acute;

basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin straight to slightly sinuate in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, prominence and file well developed; blade narrow and elongate, acute apically. Protibia with a single row of punctures on anterior face. Metacoxal processes conjointly with hind margin very broadly and slightly angulate medially.

Male protibia width = 0.16 mm, protarsal ratio = 0.78: 0.94: 0.83 (Fig. 71D); tarsomeres 1 and 2 with two and one pair of oval scales beneath, respectively; protarsal claws (Fig. 71C) strongly arcuate basally, anterior claw evidently sinuate along ventral surface and with apex shortly arcuate. Aedeagus (Fig. 71F, G) in lateral aspect more or less straight in apical half with apical knob slightly deflected ventrad; broad in dorsal aspect, with a slight medial constriction and apex slightly produced.

Comments. Gordon (1981) recognized two subspecies. The nominate subspecies, *H. s. signatus*, is transcontinental in the boreal zone, with its range extending from Newfoundland to Alaska, and south to Pennsylvania, Michigan and Wisconsin east of the Great Plains, and to Colorado in the west. The subspecies *H. s. youngi* Gordon occurs in the southeastern United States, from Pennsylvania and Ohio to Florida and Alabama. The two subspecies are separated most reliably on the shape of the aedeagus, that of *H. s. youngi* being broader in both lateral and dorsal aspects than is the aedeagus of *H. s. signatus*. Other distinguishing features of *H. s. youngi* are: more densely punctate pronotal disc and elytron, and metacoxal plate more coarsely punctate with punctures almost as coarse as those of the metasternal wing.

Within *H. s. signatus*, the ground color of the body and extent of elytral maculation varies greatly both within populations as well as between localities. Specimens in some samples, especially from shallow, barren pools, are very pale with the elytra pale brown and lacking evident pattern. Color variation appears to correlate more with habitat than with geographical range.



Map 92. *Hydroporus signatus* Mannerheim. Canadian and Alaskan collection localities and United States state records.

Ecology. These beetles occur most frequently in small barren pools where the substrate is composed primarily of mineral material. However, specimens also occur in small, barren or sparsely vegetated peatland pools. All larval instars are described by Alarie (1991).

Distribution. Map 92. The range of *H. s. signatus* extends from Newfoundland to Alaska, primarily within the boreal region, whereas *H. s. youngi* occurs in the eastern United States from the southern limits of the range of *H. s. signatus* south to Alabama.

Hydroporus civicus-group
Fig. 72

Large, length = 4.2 to 4.3 mm, somewhat elongate and subparallel but lateral outline discontinuous in dorsal aspect; color basically dark reddish to rufopiceous; punctation relatively fine; pronotum with lateral bead widening gradually to anterolateral angle, posterolateral angle slightly protruding but narrowly rounded apically; lateral margin in lateral aspect slightly arcuate; elytron in lateral aspect with lateral margin ascendant, epipleuron hidden posterad to shoulder; protibia with a single longitudinal row of punctures on anterior face; male protarsus broadly dilated, protarsomere 1 with 2 and protarsomere 2 with 1 pair of small elongate scales; protarsal claws slender, dissimilar in shape; aedeagus in ventral aspect broad with a slight medial constriction and a small apical projection.

This group contains one Mexican species of uncertain affinities. In some characteristics such as moderately large size, color and male characters, it seems related to members of the *H. niger*-group. However, the discontinuous body outline and ascendant lateral margin of the elytron differ from members of the group.

15. *Hydroporus civicus* Sharp 1887
Fig. 72.

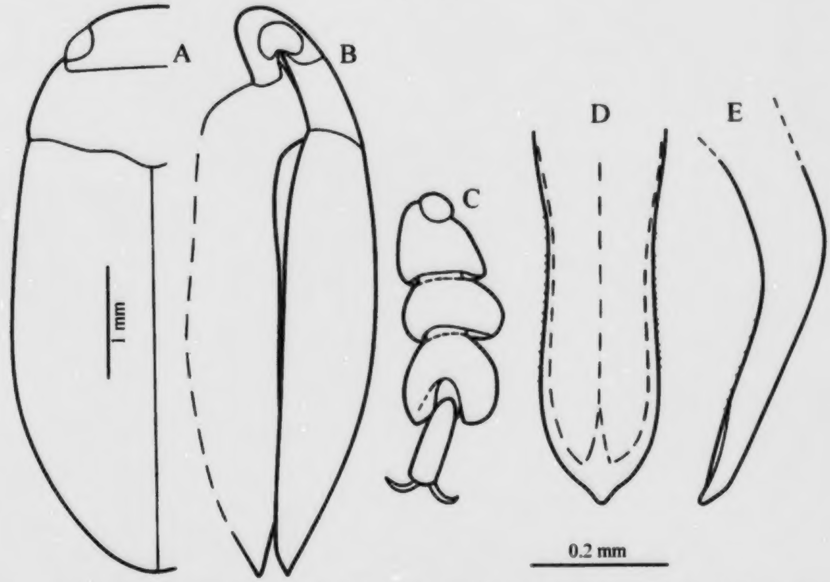


Fig. 72. *Hydroporus civicus* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsus. D - aedeagus apex, vental. E - aedeagus, lateral.

Hydroporus civicus Sharp 1887: 755. Type locality - Mexico, Ciudad in Durango; type in BMNH. Type not examined.

Description. Measurements of two specimens (male, female) are: length = 4.2, 4.3 mm, width = 2.1 , 2.2 mm, length: width = 1.95, 2.00. Body (Fig. 72A, B) somewhat elongate, subparallel, widest slightly behind middle. Pronotum broad, lateral margin more arcuate than that of elytron and therefore lateral outline discontinuous in dorsal aspect.

Color basically dark reddish to rufopiceous. Head red except frons between eyes and along hind margin dark brown to piceous; antenna reddish, antennomeres 3 or 4 to 11 infuscate; maxillary palpus with apical palpomere infuscate; labial palpus yellow. Pronotum rufopiceous medially, lateral margins broadly reddish. Elytron reddish brown, humeral angle slightly paler. Ventral surface mainly dark reddish to piceous. Legs reddish, femora slightly darkened basally and medially, especially metafemur.

Head finely and sparsely punctate. Pronotum medially with intermixed setiferous punctures and small punctures which lack distinct setae; laterally punctures larger and denser. Elytron with punctures small but dense, separated by about their own diameters, each bearing a setae about two times as long as distance between punctures; epipleuron evidently punctate. Metasternal wing with coarse, more or less contiguous punctures; metacoxal plate laterally with large but shallow, separated punctures, mesally with punctures smaller, sparser and shallower. Sterna 1 and 2 with moderate, evenly spaced punctures; sternum 6 with punctures small and deep, more or less evenly distributed over surface except crowded along hind margin. Microreticulation evident on pronotum and elytron, surface shiny and similar on both sexes.

Pronotum with lateral bead narrowest basally and widening gradually to anterolateral angle; posterolateral angle slightly protruding but narrowly rounded apically; in lateral aspect, lateral margin slightly arcuate. Elytron in lateral aspect with lateral margin ascendant; epipleuron hidden behind lateral margin for a short distance behind shoulder. Prosternal file with evident transverse ridges, prominence present as a low transverse carina; prosternal process narrow, tectiform, densely setose, bluntly pointed apically. Metacoxal processes conjointly with hind margin very slightly and broadly protruding. Protibia with a single longitudinal row of punctures on anterior face.

Male protibia width = 0.20 mm; protarsus (Fig. 72C) short, broadly dilated; protarsal ratio = 0.86: 0.95: 0.86; protarsomere 1 with two and protarsomere 2 with one pair of small elongate scales; protarsal claws slender, subequal in length but dissimilar in shape, anterior claw evenly arcuate, posterior claw rather strongly bent basally. Aedeagus (Fig. 72D, E) in ventral aspect broad with a slight medial constriction and a small apical projection.

Taxonomic Note. The two specimens that we examined were collected close to the type locality (MEXICO, Durango, W. of La Cuidad, 9000', IV.13.68, J. R. Z(immerman)). They fit Sharp's description very well and give us confidence that the name is correctly interpreted.

Ecology. The habitat has not been recorded.

Distribution. The species is known only from Durango, Mexico.

Hydroporus lapponum-group
Figs. 73 – 75

Species of moderately large size, length = 4.1 to 5.0 mm; body distinctly discontinuous in outline; color piceous to black but pronotum laterally and elytron with diffuse to distinct pale markings; pronotum with lateral bead narrow, lateral margin not reflexed upwards on anterolateral angle; elytron in lateral aspect with lateral margin strongly ascendant, epipleuron visible to or almost to shoulder; male protarsus broadly dilated, protarsomere 1 ventrally with two pairs of large adhesive scales.

This group contains two Nearctic and one Holarctic species which occur in arctic, alpine and subalpine regions.

16. *Hydroporus lapponum* (Gyllenhal 1808)
Fig. 73.

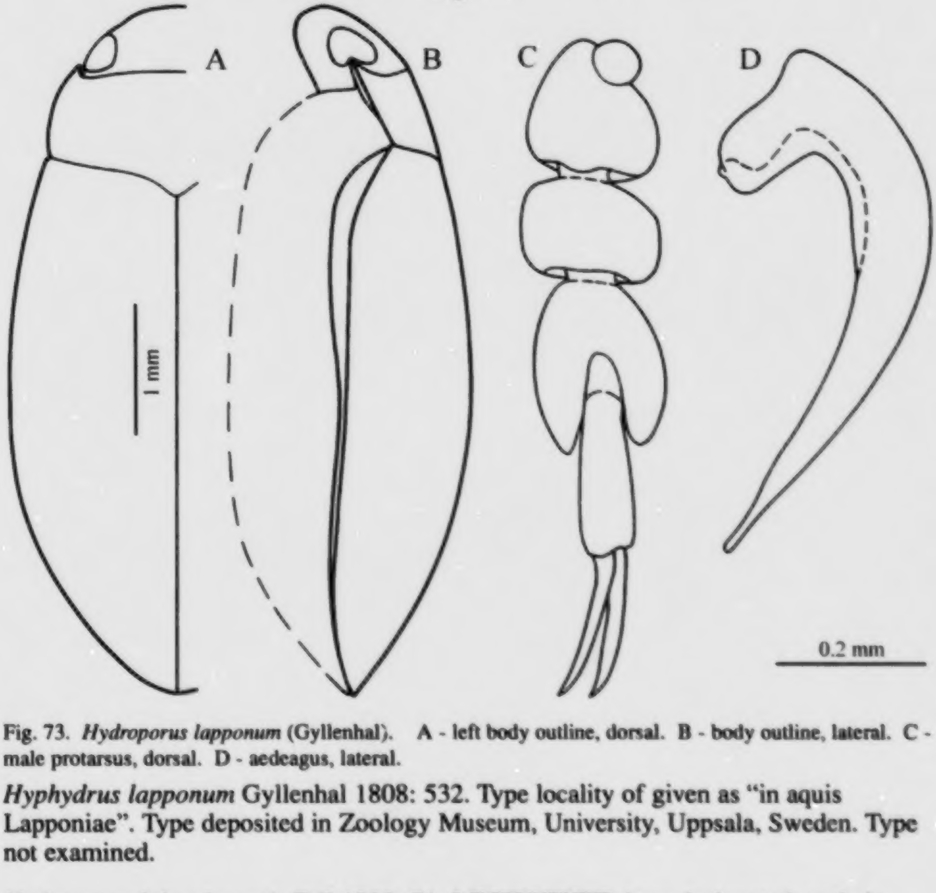


Fig. 73. *Hydroporus lapponum* (Gyllenhal). A - left body outline, dorsal. B - body outline, lateral. C - male protarsus, dorsal. D - aedeagus, lateral.

Hyphydrus lapponum Gyllenhal 1808: 532. Type locality of given as "in aquis Lapponiae". Type deposited in Zoology Museum, University, Uppsala, Sweden. Type not examined.

Hydroporus labradorensis Fall 1923: 71. **LECTOTYPE,** here designated, male in AMNH labelled: Battle Harbour, VII.30-VIII.4, Labr. (F3159 on underside)/ Amer. Museum N.H./ 98, LECONTE COLL., 1913/ TYPE (red label)/ labradorensis, Fall/ LECTOTYPE, *Hydroporus labradorensis* Fall, 1923, desig. Larson and Roughley (red label). NEW SYNONYMY.

Hydroporus humeralis; Sherman 1910, not Aubé 1838.

Selected References. Mannerheim 1853: 162; Sharp 1882*a*: 477; Fall 1923: 69; Angus 1985: 275; Nilsson and Holmen 1995: 61.

Description. Length = 4.2 to 5.0 mm, width = 2.1 to 2.5 mm, length: width = 1.88 to 2.12. Body (Fig. 73A, B) elongate-oval, widest in apical two-thirds of elytra and rounded posteriorly. Pronotum broad, lateral margin more arcuate than that of elytron and therefore lateral outline of body discontinuous in dorsal aspect; discontinuity more pronounced in males than females.

Color reddish brown to black. Head dorsally yellowish brown to reddish with hind margin and a spot mesad to each eye, piceous or black, these dark spots may be contiguous medially; head ventrally reddish; antenna yellow basally, antennomeres 3 or 4 to 11 infuscate apically to almost entirely black; palpi yellow with apical palpomere of each palpus infuscate. Pronotum brown to black except most specimens with entire anterolateral angle and lateral margins posterior to angle, broadly yellow; pale lateral margin not attaining base, posterolateral angle piceous or at least piceous hind margin of pronotum extended laterad to posterolateral angle. Elytron with color various, testaceous to almost black, most specimens with base and lateral margin testaceous and disc distinctly darkened medially, many specimens with pale areas expanded, darkened area may be reduced to a subhumeral spot and a medial discoidal longitudinal brown area or stripe on elytral base, darkened areas more expanded apically (some specimens with elytron pale yellow with sutural margin and two broader apically contiguous vittae, slightly darkened), without distinct transverse vittae; epipleuron reddish. Ventral surface mainly piceous to black except prosternum and its process, metacoxal process, and apical and lateral areas of sterna, yellow to reddish on many specimens. Legs yellow to brown with tarsi infuscate.

Head with small, sparse punctures on frontoclypeus and occiput, punctures coarser and denser in chevron-shaped area beginning over antennal bases and converging at level of posterior margin of eyes. Pronotum of most males with disc finely and sparsely punctate medially, or some specimens with area around or just laterad of medial fovea, impunctate; females with this area lacking punctation on most specimens; marginal areas of disc with punctures closer and evident. Elytron with punctures fine to moderate size, subequal to those on base of pronotum, each bearing a greenish seta, seta longer than distance between punctures; epipleuron sparsely and finely punctate. Metasternum laterally and sterna 1 and 2 laterally coarsely punctate; metacoxal plate with punctures smaller, shallower and more widely spaced, separated by about two times their own diameter; sternum 6 with punctures moderate and uniformly distributed, with a medial transverse depression in ventral view. Microreticulation of male less distinct, shiny; female either somewhat shiny or with sculpture very fine and dense and surface matte.

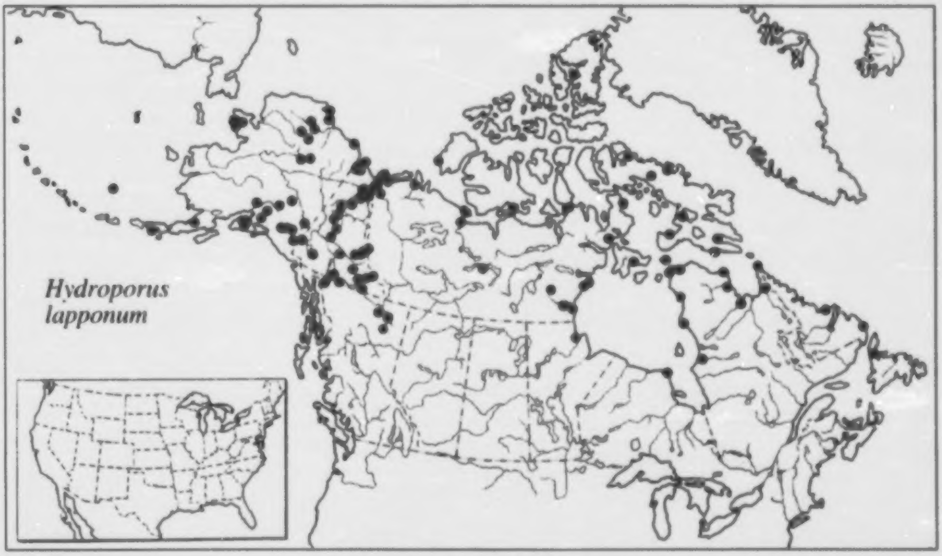
Pronotum broad, depressed anterolaterally, disc of most specimens with a poorly defined transverse impression posterior to medial smooth area; lateral bead narrow, poorly defined on many specimens; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle obtuse; basal margin shallowly sinuate on each side of posteromedial lobe. Elytron with lateral margin strongly and evenly ascendant in lateral aspect, epipleuron visible to or almost to humeral angle. Prosternum not modified, prominence and file poorly developed; blade narrow and elongate, abruptly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male protibia width = 0.20 mm, protarsal ratio = 0.82 : 0.95 : 0.88 (Fig. 73C); protarsomere 1 with two and tarsomere 2 with one pair of large, oval, adhesive scales on ventral surface; claws elongate, subequal in length, anterior claw slightly broader and more arcuate than posterior claw. Aedeagus (Fig. 73D) short and broad in ventral aspect, sides slightly constricted medially, narrowed in apical third to quarter to an acute point.

Comments. This species varies considerably in color. The palest specimens examined were from Lake Hazen, Ellesmere Island. Many of these specimens have pale yellow elytra with darkened areas only slightly darker than the background and in the form of a sutural and two broader longitudinal vittae on each elytron. On the other hand, some of the darkest specimens seen were from Baffin Island, northern Quebec, and Labrador. The head of many of these specimens is largely dark reddish to piceous grading to slightly paler on clypeus, pronotum black except anterolateral angles and anterolateral margins, brown, elytra brown to piceous, variously paler laterally and basally. The name *H. labradorensis* Fall was applied to this dark form. Specimens from west of Hudson Bay are paler.

Angus (1985) compared two male specimens of *H. labradorensis* from Port Burwell, Quebec, with Finland specimens and noted that they differed in having slightly longer anterior protarsal claws and the aedeagus and parameres were slightly narrower. These differences are minor considering the great distance separating the populations and do not constitute grounds for recognition of two species.

Ecology. Specimens have been collected from small, shallow, tundra pools with dense moss and emergent vegetation. They occur along the margins of small rocky pools in the Long Range Mountains, Newfoundland, and probably inhabit this type of habitat over much of the eastern arctic. Nilsson and Holmen (1995) report this to be the typical habitat in Scandinavia. The species is common in forested areas of the southern Yukon Territory and northern British Columbia where specimens occur among *Carex* in marshes, at the margins of small pools and among vegetation at the margins of newly



Map 93. *Hydroporus lapponum* Gyllenhal. Canadian and Alaskan collection localities and United States state records.

formed or flooded ponds. Nilsson and Carr (1989) have described the larva. The life cycle is predominantly univoltine with adults overwintering although some larvae may overwinter facultatively (Nilsson and Carr 1989).

Distribution. Map 93. The range is Holarctic in the arctic and northern boreal zones. The North American range extends from the Long Range Mountains of northwestern Newfoundland to northern British Columbia, and north to northern Ellesmere Island. It is peculiar that the species does not occur in Greenland.

17. *Hydroporus mannerheimi* Balfour-Browne 1944

Fig. 74

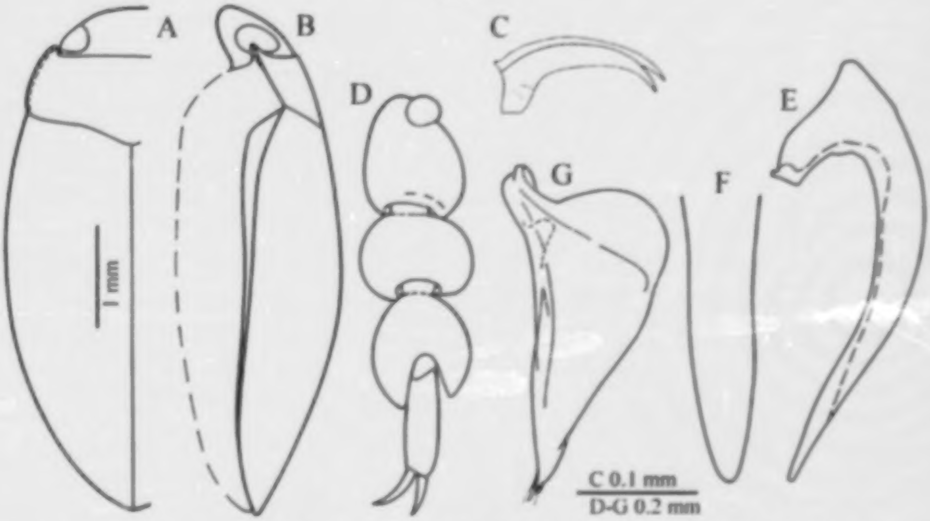


Fig. 74. *Hydroporus mannerheimi* Balfour-Browne. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral. G - paramere.

Hydroporus humeralis Aubé 1838*b*: 578. Type locality given as United States. Type, probably in IRHN, not examined [not Marsham 1802].

Hydroporus mannerheimi Balfour-Browne 1944: 349. New name for *H. humeralis* Aubé.

Selected References. Fall 1923: 68; Leech 1949: 244; Hatch 1953: 209; Leech and Chandler 1956: 317; Larson 1975: 297.

Description. Length = 4.1 to 4.7 mm, width = 1.9 to 2.4 mm, length: width = 1.95 to 2.11. Body (Fig. 74A, B) elongate, narrowly oval, widest at middle and rounded posteriorly; male narrower than female. Pronotum of male broad, lateral margin more arcuate than that of elytron and therefore lateral outline of body discontinuous in dorsal aspect; pronotum of female narrower and lateral outline less discontinuous.

Color dark brown to black, most specimens with distinct paler maculations. Head dorsally brown to piceous medially and posteriorly, with frontal bar, clypeus, anteromedial portion of frons and narrow margin of eye, pale yellow to red; head ventrally reddish. Antenna yellow basally, antennomeres 3 to 11 increasingly darkened; palpi yellow, maxillary palpus and also labial palpus of most specimens with apical palpomere infuscate apically. Pronotum with disc black, paler laterally with anterolateral angle entirely pale, lateral margin broadly pale to posterolateral angle or not, limits of pale area on disc diffuse on many specimens. Elytron with color various, disc dark brown to piceous, most specimens with a pattern of paler markings although these may be variously reduced, typically lateral margin narrowly pale with pale incursions or sublateral spots on disc at base, subbasally, postmedially and subapically; epipleuron yellowish to dark rufous. Ventral surface mainly black. Legs reddish with femora basally, tibiae apically and tarsi darker.

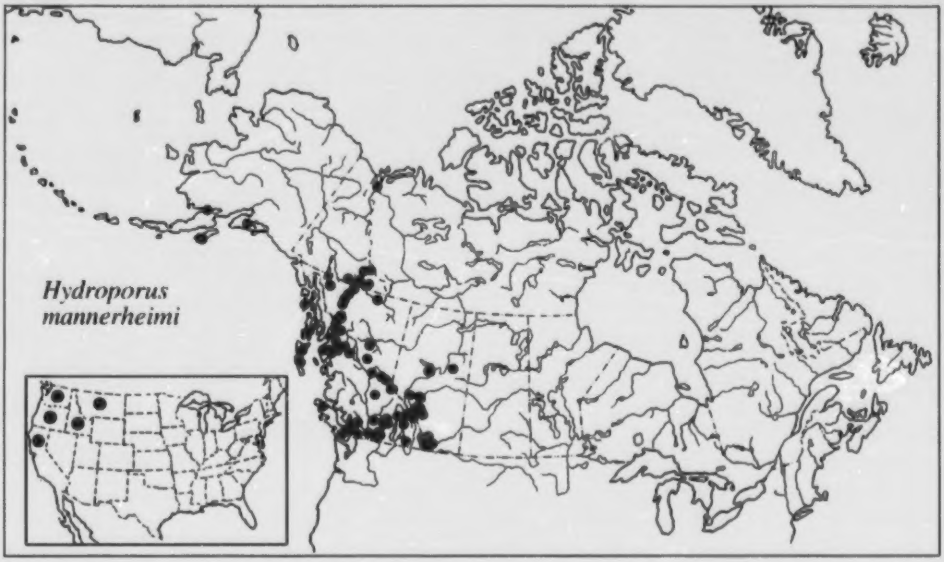
Head with dual-sized, moderately dense punctures. Pronotum punctate over entire disc, medially punctures somewhat sparser, of irregular size but generally smaller; punctures somewhat denser posteriorly and on posterolateral angle. Elytron with punctures dense and about same size as those on base of pronotum, punctures separated by one to one and one half times their diameter, each bearing a pale seta, seta longer than distance between punctures; epipleuron distinctly punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally moderately punctate, punctures subequal in size; sternum 6 with small evenly distributed punctures or punctures slightly denser apically on male. Microreticulation of male with sculpture open and body somewhat shiny, elytron with distinct meshes, some somewhat transverse in shape; female with lines very dense and surface matte.

Pronotum with lateral bead poorly delimited; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle of male broadly rounded, that of female obtuse; basal margin sinuate on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin strongly ascendant, epipleuron visible to or almost to shoulder. Prosternum not modified; process with prominence and file well developed; blade broadly ovate, narrowed to bluntly pointed apex. Protibia with a single row of punctures on anterior face. Metacoxal processes conjointly with hind margin slightly arcuate near midline and shortly produced or angulate medially.

Male protarsus (Fig. 74D) broadly dilated; protibia width = 0.17 mm, protarsal ratio = 0.95: 1.00: 0.90; protarsomere 1 with two pairs of elongate scales beneath, protarsomere 2 lacking such scales; anterior protarsal claw (Fig. 74C) slightly broader and more arcuate apically than posterior claw. Aedeagus (Fig. 74E, F) slender in lateral aspect, slightly sinuate apically; in dorsal aspect not evidently narrowed medially, apex bluntly pointed.

Ecology. Specimens have been collected from a variety of habitats ranging from the rocky shorelines of small alpine and subalpine lakes, the emergent zone of subalpine lakes and beaver ponds, and depositional areas that support emergent sedges or rushes along small, low gradient streams. The beetles are generally in permanent habitats with clear, usually cool, water. Teneral specimens occur from early July to early August, with the majority collected the end of July.

Distribution. Map 94. The range extends from coastal Alaska to California, and east to the Nahanni Mountains of the Northwest Territories and the Rocky Mountains and Swan Hills of Alberta.



Map 94. *Hydroporus mannerheimi* Balfour-Browne. Canadian and Alaskan collection localities and United States state records.

18. *Hydroporus tademus* Leech 1949

Fig. 75

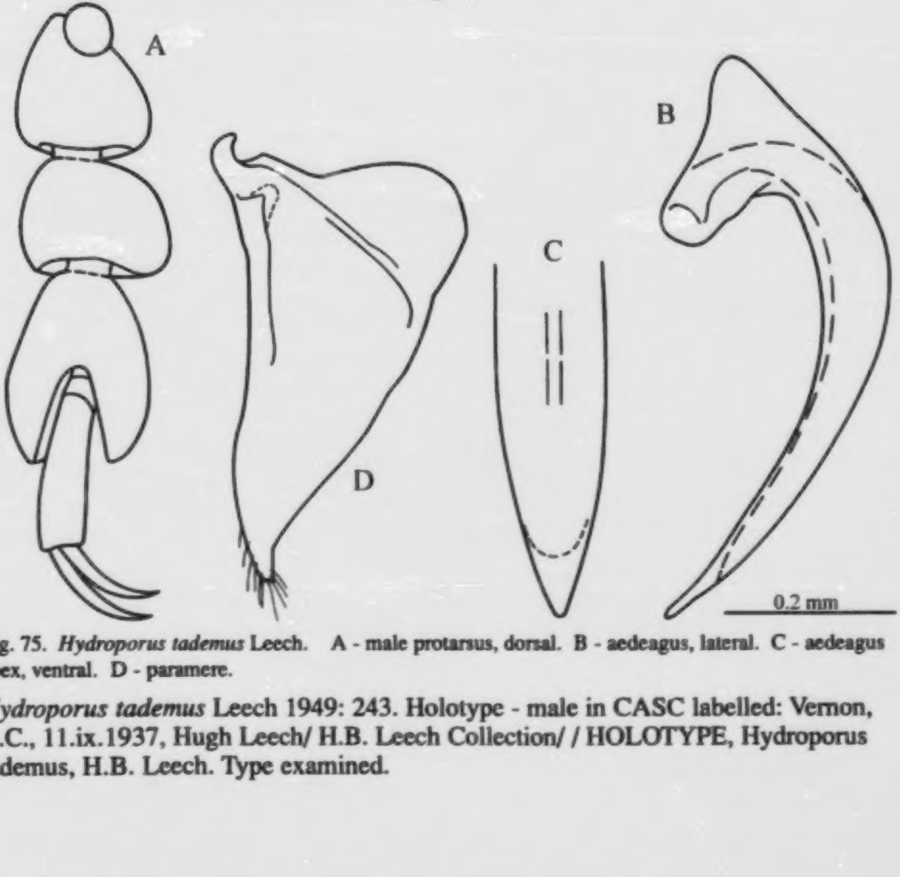


Fig. 75. *Hydroporus tademus* Leech. A - male protarsus, dorsal. B - aedeagus, lateral. C - aedeagus apex, ventral. D - paramere.

Hydroporus tademus Leech 1949: 243. Holotype - male in CASC labelled: Vernon, B.C., 11.ix.1937, Hugh Leech/ H.B. Leech Collection/ / HOLOTYPE, Hydroporus tademus, H.B. Leech. Type examined.

Selected References. Hatch 1953: 209; Leech and Chandler 1956: 317; Larson 1975: 297.

Description. Length = 4.1 to 4.8 mm, width = 2.0 to 2.6 mm, length: width = 1.9 to 2.0. Similar to *H. mannerheimi* but of generally more robust form, more uniform color, elytra more rounded laterally and dorsal surface more convex. Body ovate, widest at middle and rounded posteriorly; male narrower than female. Pronotum of male broad, lateral margin more arcuate than that of elytron and therefore lateral outline of body discontinuous in dorsal aspect; pronotum of female narrower and lateral outline less discontinuous.

Color dark brown to black and most specimens with distinct maculations. Head dorsally reddish with a large spot mesad to each eye and hind margin, dark brown to piceous; ventral surface reddish; antenna yellow basally, antennomeres 5 to 11 increasingly darkened apically; palpi yellow, maxillary palpus and also labial palpus of some specimens with apical palpomere infuscate apically. Pronotum with disc brown to rufopiceous, laterally reddish yellow, pale lateral color grading into darker discal color and not sharply limited. Elytron with color various, reddish brown to piceous, paler yellowish laterally, most specimens with humeral angle and a subapical spot on each elytron pale but some also with humeral spot expanded as a subbasal transverse yellow fascia; epipleuron yellowish. Ventral surface largely piceous to black. Legs reddish with femora basally, tibiae apically and tarsi darker.

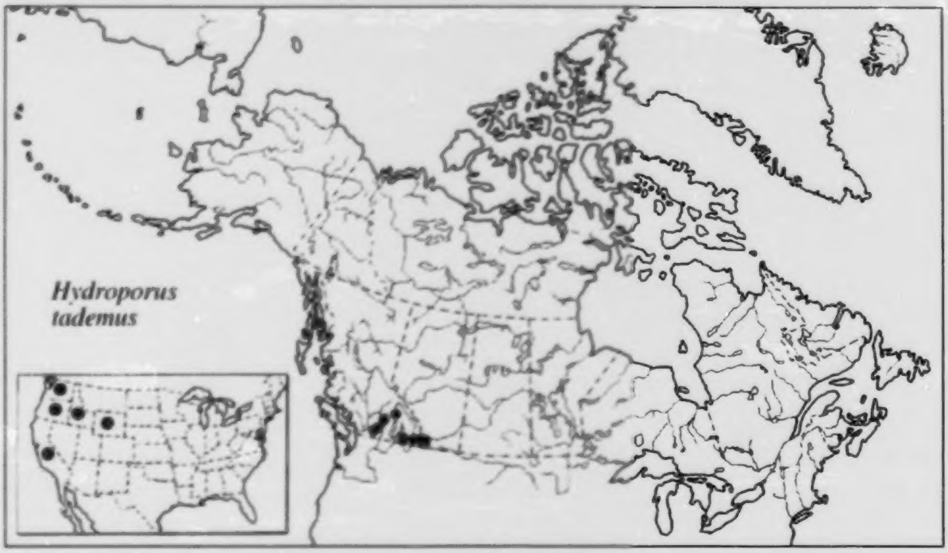
Head with dual-sized, moderately dense punctures. Pronotum punctate over entire disc, medially punctures smaller, sparser and of irregular size; punctures somewhat denser posteriorly and on posterolateral angle. Elytron with punctures dense and about same size as those on base of pronotum, punctures separated by one to one and one half times their diameter, each bearing a pale seta, seta longer than distance between punctures; epipleuron finely and sparsely punctate. Metasternum laterally and sterna 1 and 2 laterally coarsely punctate, punctures on metacoxal plate smaller, shallower and more widely spaced, separated by about two times their own diameter; sternum 6 with small evenly distributed punctures. Microreticulation of male with sculpture open and body somewhat shiny, elytron with distinct meshes, some somewhat transverse in shape; female with lines very dense and surface matte.

Pronotum with lateral bead poorly delimited; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle of male broadly rounded, that of female obtuse; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin strongly ascendant in lateral aspect, epipleuron visible to or almost to shoulder. Prosternum not modified; process with prominence and file well developed; blade broadly elongate, bluntly pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male with protarsomeres 1 to 3 broadly dilated (Fig. 75A); protibia width = 0.18 mm, protarsal ratio = 0.95: 1.02: 0.90; tarsomere 1 with two pairs of scales beneath; differing from those of *H. mannerheimi* in that protarsomere 2 is asymmetrical and tarsomere 3 more elongate or parallel sided (also in female). Aedeagus (Fig. 75B, C) differing from that of *H. mannerheimi* in that it is shorter and not sinuate in lateral aspect, more pointed apically in dorsal aspect.

Ecology. These beetles occur among emergent vegetation along the margins of permanent ponds such as beaver ponds. All records are within the subalpine zone and the species apparently occurs in lower elevation, more eutrophic habitats than occupied by *H. mannerheimi*.

Distribution. Map 95. The range extends from southwestern Alberta and southern British Columbia to Wyoming and northern California.



Map 95. *Hydroporus tademus* Leech.Canadian and Alaskan collection localities and United States state records.

Hydroporus columbianus-group

Figs. 76 – 78

Large to very large species, length = 5.0 to 7.1 mm. Color dark rufous to black, ventral surface mainly dark. Elytron with punctation fine and dense, setae dense. Pronotum in lateral aspect with lateral margin not reflexed upwards on anterolateral angle. Elytron in lateral aspect with lateral margin ascendant to humeral angle. Male with pro- and mesotarsomeres 1 with numerous small, round adhesive scales on ventral surface.

This group contains three large, black species of *Hydroporus* and is based primarily on large body size and dense punctation and vestiture. The included species are quite diverse and it is likely the group as here constituted is composite.

19. *Hydroporus fortis* LeConte 1851

Fig. 76

Hydroporus fortis LeConte 1851: 207. Type - male in MCZC, on pin with gold disc (type locality given as San Diego, California); MCZC type 6030. Type examined.

Selected References. LeConte 1855: 292; Crotch 1873: 394; Sharp 1882*a*: 477; Fall 1923: 71; Hatch 1953: 205; Leech and Chandler 1956: 317.

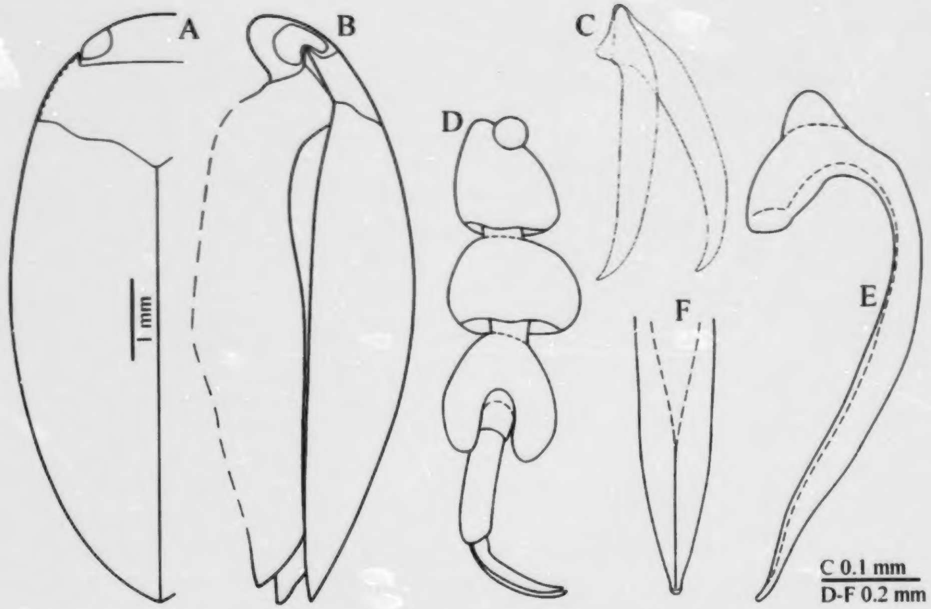


Fig. 76. *Hydroporus fortis* LeConte. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Description. Length = 6.0 to 7.1 mm, width = 3.2 to 3.7 mm, length: width = 1.82 to 1.97. Body (Fig. 76A, B) very large and quite convex, ovate, widest at middle and attenuate posteriorly; pronotum with lateral margin slightly more arcuate than that of elytra thus lateral outline slightly discontinuous in dorsal aspect.

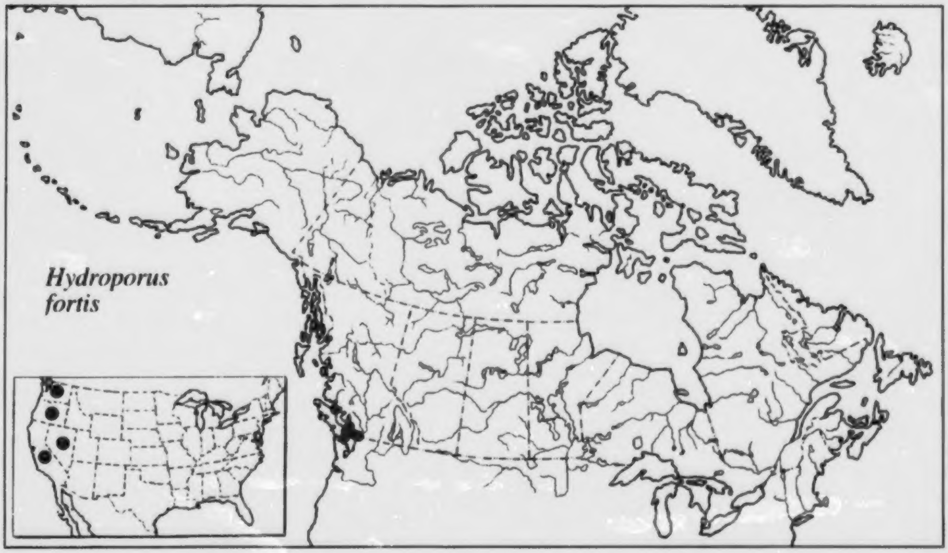
Color dark brown to black. Head dorsally piceous to black except frontal bar and anterior margin of clypeus, reddish; head ventrally with genae piceous to black, gula reddish to piceous; antenna yellow basally, antennomeres 2 and 3 lightly infuscate, 4 or 5 to 11 extensively infuscate; palpi yellow with terminal palpomere of each palpus largely infuscate. Pronotum dark red to piceous with anterior and posterior margins darker. Elytron piceous medially, base and lateral margin rufescent; epipleuron piceous. Ventral surface mainly black except abdominal sterna reddish laterally. Legs reddish to piceous.

Head with small, deep punctures, denser medially between eyes, sparser towards margins. Pronotum with fine, dense punctures, punctation more or less even over disc but laterally punctures arranged in irregular longitudinal grooves or impressions (best developed on male). Elytron very densely and finely punctate, punctures finer than those of pronotum, separated by a distance equal to their own diameters or less; each puncture bearing a pale silvery seta about five times or more as long as distance between punctures; epipleuron finely and densely punctate. Ventral surface with punctures relatively small, shallow and dense; punctures coarsest on metasternum laterally and sterna 1 and 2 laterally but disparity with remaining abdominal punctation slight; metacoxal plate with punctures small and dense, punctures shallow and not conspicuous due to coarse microreticulation, smaller in size and less conspicuous than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures very densely crowded medioapically, more widely spaced anteriorly. Male with microreticulation lightly impressed, obsolete or absent medially on pronotum and basally on elytron; strongly impressed on venter of metathorax, lighter on abdominal sterna. Female dull dorsally with fine microreticulation present over entire surface.

Pronotum with lateral bead fine, poorly defined, of uniform width throughout length; lateral margin in lateral view straight on anterolateral angle narrowly exposing epipleuron; lateral margins broadly converging anteriorly and pronotum widest at hind angles; posterolateral angle acute; basal margin sinuate on each side of posteromedial lobe. Elytron in lateral aspect with lateral margin slightly and broadly sinuate basally; epipleuron disappearing well posterior to shoulder. Prosternum not modified; process well developed, file and prominence strongly developed; blade broadest basally posterior to procoxae, sides more or less evenly narrowed to narrowly rounded apex; densely setose. Legs slender. Protibia in anterior aspect relatively slender; anterior face with a single longitudinal row of closely spaced, small punctures. Metacoxal processes conjointly with hind margin faintly sinuate with a small indentation just mesad of intersection of each coxal line.

Male protibia width = 0.25 mm, protarsal ratio = 0.94: 1.17: 1.00 (Fig. 76D); protarsomeres 1 to 3 ventrally with many small adhesive scales; protarsal claws (Fig. 76C) elongate, subequal, posterior claw straighter and with ventral margin straighter than that of anterior claw. Aedeagus (Fig. 76E, F) elongate and slender in lateral aspect, slightly sinuate apically.

Ecology. The species occurs in permanent, usually spring- or stream-fed forest pools, amongst emergent vegetation growing on peaty or organic substrates. At higher elevations in California it is found in springs, bogs and seepages. It occurs from sea level to about 2000 m elevation (Salmon Mts., Siskiyou Co., CA).



Map 96. *Hydroporus fortis* LeConte. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 96. The species occurs along the Pacific coast, from southwestern British Columbia to southern California, and in the Sierra Nevada Mountains of northern and central California.

20. *Hydroporus leechi* Gordon 1981

Fig. 77

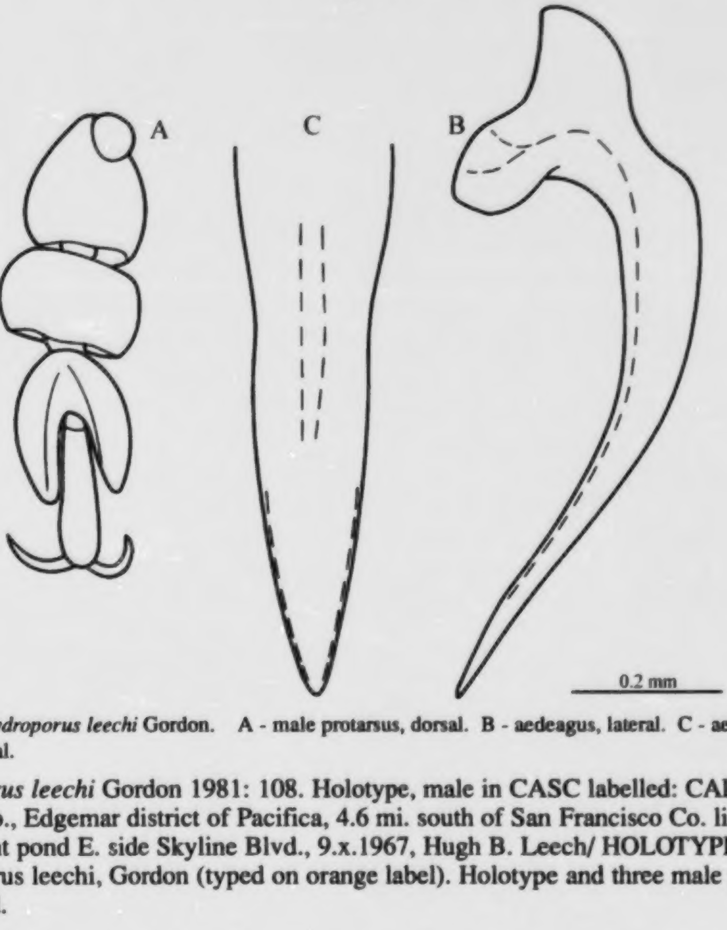


Fig. 77. *Hydroporus leechi* Gordon. A - male protarsus, dorsal. B - aedeagus, lateral. C - aedeagus apex, ventral.

Hydroporus leechi Gordon 1981: 108. Holotype, male in CASC labelled: CAL. San Mateo Co., Edgemar district of Pacifica, 4.6 mi. south of San Francisco Co. line/ permanent pond E. side Skyline Blvd., 9.x.1967, Hugh B. Leech/ HOLOTYPE, Hydroporus leechi, Gordon (typed on orange label). Holotype and three male paratypes examined.

Description. Length = 5.2 to 5.6 mm, width = 2.6 to 2.8 mm, length: width = 1.93 to 2.00. Body in dorsal aspect elongate-oval, elytra subparallel basally with widest point of body near middle of elytra. Pronotum with posterolateral angle slightly rounded, therefore lateral outline slightly discontinuous in dorsal aspect.

Color black or with pronotum darker than brownish elytron. Head dorsally piceous except frontal bar and anterior margin reddish; head ventrally reddish yellow to piceous. Antenna yellow basally, outer antennomeres dark brown; palpi yellowish with terminal palpomere of each palpus largely infuscate apically. Pronotum piceous to black medially, lateral margin broadly rufopiceous. Elytron dark reddish to piceous; epipleuron reddish. Ventral surface mainly piceous to black except abdominal sterna 3 to 5 laterally and sternum 6 apically, reddish. Legs reddish to brownish.

Head with moderately dense small punctures between eyes, otherwise finely and sparsely punctate. Pronotum with disc densely punctate, medially punctures of more or less similar size and separated by slightly more than their diameters, punctures slightly larger and closer towards margins, some more or less contiguous laterally and basally. Elytron with punctures finer than those of pronotum, dense and separated by their own diameters or less, each puncture bearing a pale, silvery seta about three to four times as long as distance between punctures; epipleuron with moderate sized, shallow but dense punctures. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally finely punctate, punctures coarsest on metasternum, smallest on metacoxal plate and larger on sterna 1 and 2 laterally; metacoxal plate with punctures small and dense, punctures shallow and not conspicuous due to coarse microreticulation, punctures separated by about three to four times their own diameter; sternum 6 coarsely punctate, punctures dense and more or less contiguous medioapically. Male with body dorsally distinctly microreticulate, elytron medially with meshes more or less isodiametric, laterally and apically meshes distinctly transverse; ventral surface of thorax coarsely reticulate, abdomen with sculpture lightly impressed, shiny. Female not known.

Antenna relatively slender, medial antennomeres about 3 times as long as wide. Labial palpus with apical palpomere very broad in lateral aspect, its posterior margin sub-angulate. Pronotum with lateral bead complete but narrow; lateral margin in lateral view straight on anterolateral angle not exposing epipleuron; posterolateral angle right angled or slightly rounded and obtuse; basal margin distinctly sinuate laterally on each side of posteromedial lobe. Elytron with lateral margin broadly ascendant to humeral angle and sinuate at shoulder in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, file and prominence distinct; blade long and narrow, rounded apically. Protibia with anterior face with a single longitudinal row of punctures. Mesotibia with mesal margin arcuate. Metacoxal processes conjointly with hind margin truncate or very slightly and broadly angulate.

Male protarsomeres 1 to 3 strongly dilated (Fig. 77A), protarsomere 2 rounded and wider than protibia and protarsomeres 1 and 3, protibia width = 0.22 mm, protarsal ratio = 0.92: 1.08: 0.96; tarsomeres 1 and 2 with numerous small oval scales ventrally; protarsal claws subequal, elongate and more or less straight medially, strongly arcuate basally and apically, slightly longer than apical protarsomere. Aedeagus (Fig. 77B, C) long, slender; in dorsal aspect sides slightly sinuate medially, in apical half tapering evenly to a point.

Ecology. The type series was collected from a permanent pond.

Distribution. The species is known only from a few male specimens collected in San Mateo Co., California.

21. *Hydroporus columbianus* Fall 1923

Fig. 78

Hydroporus columbianus Fall 1923: 78 – 79. Holotype, female in MCZC labelled: Golden, B.C.; MCZC type 23922. Type examined.

Selected references. Hatch 1953: 206; Larson 1975: 294; Hilsenhoff 1995: 9.

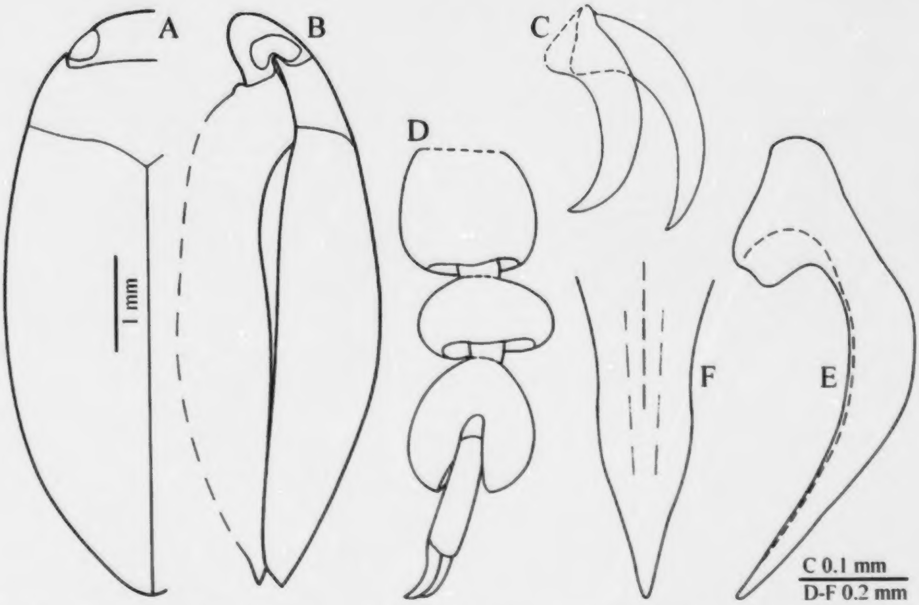


Fig. 78. *Hydroporus columbianus* Fall. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Description. Length = 5.0 to 6.3 mm, width = 2.7 to 3.2 mm, length: width = 1.92 to 2.05. Size large, body (Fig. 78A, B) ovate, widest at middle and attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color dark rufous to piceous. Head dorsally red with hind margin and a large triangular spot mesad of each eye, piceous; head ventrally red; antenna pale basally, outer antennomeres infuscate; palpi yellow, maxillary palpus with terminal palpomere infuscate, labial palpus with terminal palpomere not or only lightly infuscate. Pronotum dark brown or piceous medially, lateral margins broadly red, pale marginal color grading into darker color of disc. Elytron reddish brown laterally, darker medially and apically; epipleuron reddish. Ventral surface mainly black. Legs reddish.

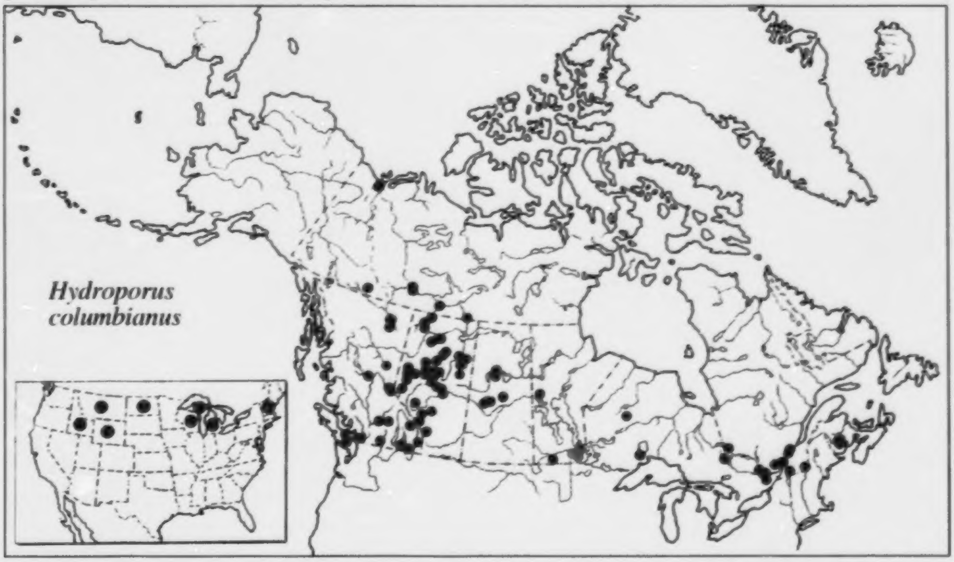
Head with small, deep punctures, relatively uniformly distributed. Pronotum medially with punctures of varied size and moderate density, punctures denser and larger laterally. Elytron with punctures slightly smaller than those on base of pronotum, separated by about their own diameters; each puncture bearing a pale seta about two to three times as long as distance between punctures; epipleuron with moderate sized, shallow punctures. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally moderately coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures moderately large and dense, punctures separated by about one and one half to two times their own diameter, shallower than those of metasternum and abdominal sterna 1 and 2 laterally; sternum 6 with punctures small and more or less evenly distributed. Microreticulation of male with meshes more or less isodiametric on pronotum, slightly transverse on elytron; female with lines denser and more deeply impressed, surface duller.

Pronotum with lateral bead relatively broad, of more or less even width throughout length; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle obtuse; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin gradually ascendant and sinuate in lateral aspect; epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, file distinct, prominence low; blade elongate-oval, narrowly rounded apically. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly with hind margin slightly angulate medially.

Male protibia width = 0.24 mm, protarsal ratio = 0.96: 0.92: 0.86 (Fig. 78D); protarsomere 1 with many round adhesive scales beneath, tarsomere 2 with two to four scales; protarsal claws (Fig. 78C) short, subequal in length, anterior claw slightly broader and more arcuate than posterior. Aedeagus (Fig. 78E, F) in lateral aspect straight apically; in dorsal aspect slightly constricted medially then evenly narrowed to pointed apex.

Ecology. Specimens occur in the emergent vegetation zone (*Carex* and *Typha*) of small ponds, boggy stream margins and springs in forested areas. All larval instars were described by Alarie (1991).

Distribution. Map 97. The range extends from New Brunswick to British Columbia, primarily within the southern portion of the boreal forest belt.



Map 97. *Hydroporus columbianus* Fall. Canadian and Alaskan collection localities and United States state records.

Hydroporus zackii-group
Fig. 79

Large, length = 4.5 to 5.0 mm, robust, lateral outline discontinuous in dorsal aspect; color rufopiceous to dark piceous; punctation of pronotum and elytra coarse and dense; pronotum laterally explanate, posterolateral angle obtuse and rounded, lateral margin in lateral aspect slightly sinuate anteriorly but not thickened or reflexed; elytron in lateral aspect with lateral margin ascendant, epipleuron disappearing well posterior to shoulder; protibia with a single row of punctures on anterior face; male protarsi broadly dilated, protarsomere 1 with three pairs and protarsomere 2 with one pair of narrow adhesive scales on ventral surface; protarsal claws elongate, strongly bent basally; aedeagus stout, in ventral aspect broadly narrowed medially.

This group contains one species of unknown affinity.

22. *Hydroporus zackii* Larson and Roughley, new species

Fig. 79

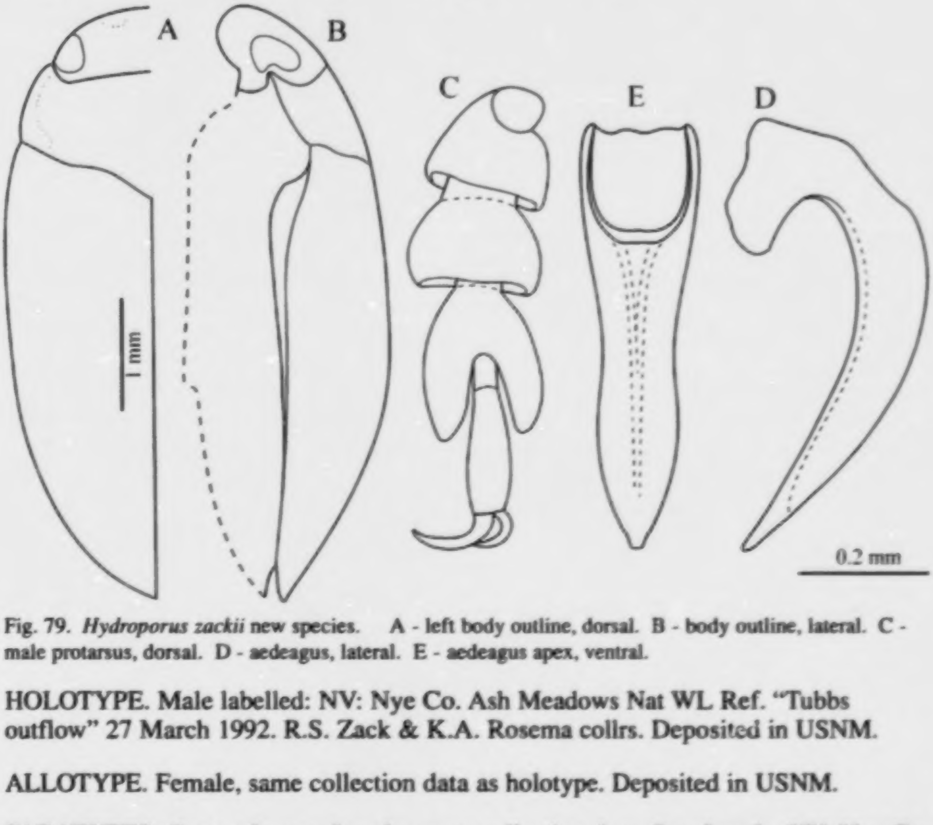


Fig. 79. *Hydroporus zackii* new species. A - left body outline, dorsal. B - body outline, lateral. C - male protarsus, dorsal. D - aedeagus, lateral. E - aedeagus apex, ventral.

HOLOTYPE. Male labelled: NV: Nye Co. Ash Meadows Nat WL Ref. "Tubbs outflow" 27 March 1992. R.S. Zack & K.A. Rosema collrs. Deposited in USNM.

ALLOTYPE. Female, same collection data as holotype. Deposited in USNM.

PARATYPES. One male, one female, same collection data. One female: NV: Nye Co. Ash Meadows Nat WL Ref. Jackrabbit Spr. 27 Mar 1992. R.S. Zack & K.A. Rosema collectors Deposited in USNM and CASC.

Description. Male ($n = 2$): length = 4.9, 5.0 mm; width = 2.4, 2.5 mm; length: width = 2.02, 2.03. Female ($n = 3$): length = 4.5 to 4.8 mm; width = 2.2 to 2.4 mm; length: width = 2.00 to 2.03. A large, robust, convex species (Fig. 79A, B); lateral outline discontinuous in dorsal aspect, especially in male.

Color of body mainly rufopiceous to dark piceous. Head rufous with hind margin piceous and a transverse reddish brown spot between eyes, eyes entirely ringed with red; ventral surface rufous; antenna with basal 3 to 4 antennomeres yellow, outer antennomeres infuscate apically; palpi yellow or some specimens with apical palpomeres slightly darkened. Pronotum piceous medially; anterolateral angle and lateral margin broadly rufous and grading into darker disk. Elytron piceous to almost black, as dark as or darker than disk of pronotum, shoulder slightly paler on some specimens; epipleuron rufous to rufopiceous. Ventral surface piceous to black with variously developed paler areas, especially on abdomen, most specimens with sternum 2 medially and sterna 3 to 5 laterally with rufous spots, these areas variously expanded and two specimens (apparently non-teneral) with abdomen entirely rufous, palest basally and laterally. Legs rufous except femora darkened on basal two thirds and on some specimens strongly contrasting with red apex and tibia.

Head with punctation fine and sparse, deepest and densest medially between eyes. Pronotum with entire disk bearing coarse, setiferous punctures, punctures well separated medially, denser basally and laterally and on lateral areas more or less longitudinally confluent. Elytron uniformly coarsely and densely punctate, punctures separated by their own diameter or less, each with a fine greenish seta slightly longer than distance between setal bases; epipleuron coarsely punctate. Metasternum laterally coarsely and more or less confluently punctate; metacoxal plate with large punctures but these shallower than those of metasternum, separated by about their own diameter, similar to punctation of sterna 1 and 2. Sternum 6 with dense, small, deep punctures, these contiguous along hind margin. Pronotum and elytron with isodiametric microsculpture, shallower in male with surface somewhat shiny, deeper on female and surface duller but not matte.

Pronotum convex medially with lateral margin evidently widened and explanate (most distinctly on male), lateral bead relatively wide, subequal in width to basal width of an outer antennomere; posterolateral angle obtuse and rounded, base shallowly but distinctly concave mesad to angle; lateral margin in lateral aspect slightly sinuate anteriorly but not distinctly thickened or reflexed. Elytron in lateral aspect with lateral margin ascendant, epipleuron disappearing well posterior to shoulder.

Prosternum impressed medially, inflated anterior to procoxa and along anterior margin; prosternal process with file well developed, prominence a strong transverse ridge; blade tectiform, rounded medially and bluntly pointed apically. Metacoxal process with hind margin slightly produced medially, conjointly slightly but distinctly angulate. Protibia with a single row of punctures on anterior face.

Male protarsi (Fig. 79C) broadly dilated; width protibia = 0.22 to 0.23 mm; protarsal ratio = 0.88: 0.96: 0.85; protarsomere 1 with three pairs and protarsomere 2 with one pair of narrow adhesive scales on ventral surface; protarsal claws elongate, similar in shape and size, basally with a slightly greater than right angle bend, almost straight and evenly tapering medially and slightly curved apically. Aedeagus (Fig. 79D, E) stout, in lateral aspect evenly tapering to narrowly rounded apex, not sinuate; in ventral aspect broadly narrowed medially.

Comments. Ash Meadows lies within a series of intermontane valleys that constitute the Death Valley System of southeastern California and southwestern Nevada. This region is known for its highly endemic biota (Hershler and Sada 1987). It is possible that *H. zackii* is a regional endemic. Such a restricted distribution is uncommon in dytiscids but is known for several species (e.g., some members of the *Hygrotus pedalis* group (Anderson 1983)) inhabiting specialized, disjunct habitats in the southwestern United States.

Ecology. Richard Zack provided the following collecting notes, "Both springs were hot. Jackrabbit was a pool in which we collected from vegetation along the margin (in the water) of the pool. Tubbs was a pool that we could not get to because of vegetation so we collected the runoff (outflow) that simply worked its way across the soil surface. The water was only a few inches deep but there was a great amount of aquatic vegetation."

Distribution. This species is known from only the type specimens collected in Nye County, south central Nevada.

Hydroporus axillaris-group
Fig. 80

Large, length = 4.6 to 5.4 mm, broadly oval, lateral outline continuous or slightly discontinuous in dorsal aspect; color reddish brown with pronotum black and contrasting with paler elytra; punctation of dorsal surface very fine and dense, metacoxal plate very finely punctate, sternum 6 with punctures dense, crowded posteriorly; microreticulation obsolete or very faint on discs of pronotum and elytra, body shiny; pronotum with posterolateral angle more or less right angled, base mesad to posterolateral angle strongly sinuate, lateral margin in lateral aspect straight; elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder; protibia with a single row of punctures on anterior face; male protarsi relatively narrow, protarsomere 1 with 2 pairs and protarsomere 2 with one pair of large scales beneath; aedeagus elongate and more or less straight apically in lateral aspect.

This group contains one species, *H. axillaris*, of the southwestern United States.

23. *Hydroporus axillaris* LeConte 1851
Fig. 80

Hydroporus humeralis LeConte 1852: 207. Type, male in MCZC, on pin with gold disc; type locality given as Colorado River; MCZC type 6031. Type examined. [Not Aubé 1838].

Hydroporus axillaris LeConte 1853a: 32. New name for *H. humeralis* LeConte.

Selected References. LeConte 1855: 292; Crotch 1873: 394; Sharp 1882*a*: 479; Fall 1923: 73; Hatch 1953: 209; Leech and Chandler 1956: 317; Anderson 1962: 62.

Description. Length = 4.6 to 5.4 mm, width = 2.4 to 2.8 mm, length: width = 1.86 to 1.97. Body (Fig. 80A, B) relatively broadly oval, widest near middle and rounded posteriorly; lateral outline continuous to slightly discontinuous in dorsal aspect.

Color reddish brown with pronotum black, many specimens with elytra distinctly maculate. Head dorsally piceous to black with frontal bar and anterior margin reddish; ventral surface entirely black; antenna reddish basally, antennomeres 5 to 11 darker apically; palpi reddish with apical palpomere of each palpus infuscate. Pronotum black. Elytron reddish brown to dark brown with at least shoulder yellow, many specimens with expanded pale areas at base and also along lateral margins antemedially, postmedially and subapically; epipleuron mostly black except yellowish at base. Ventral surface of body black. Legs pale brown with femora darker.

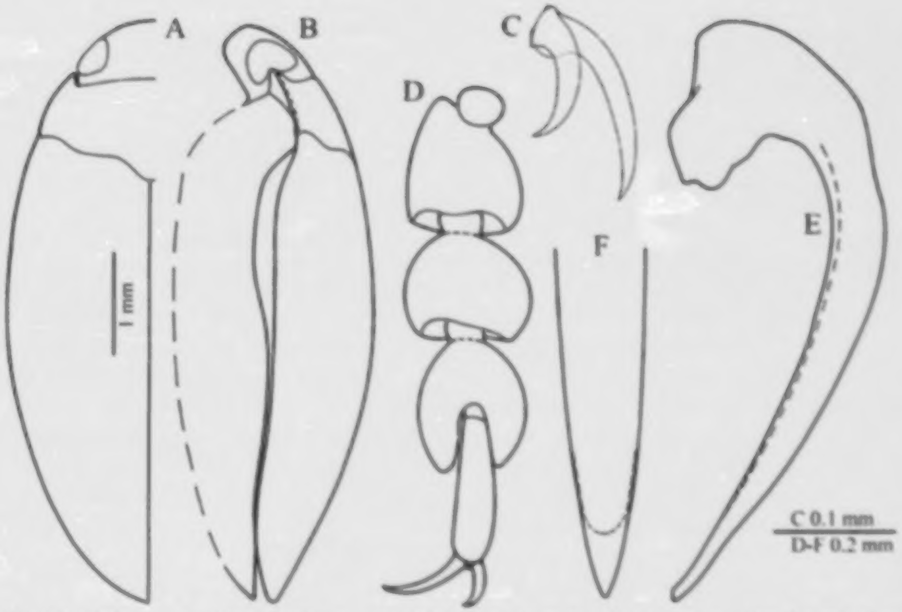


Fig. 80. *Hydroporus axillaris* LeConte. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Head with very small and sparse punctures. Pronotum with punctures small, dense and of more or less uniform size, bearing long, somewhat flattened, yellow setae. Elytron with punctures very fine, dense, separated by their own diameter, bearing slender yellow setae; epipleuron with punctures larger than those of elytron and sparser. Metasternum laterally with coarse punctures; metacoxal plate with punctures very small and sparse, not conspicuous due to coarse microreticulation; abdominal sterna 1 and 2 laterally distinctly punctate; sternum 6 with punctures small, deep and dense at base, denser posterior and more or less contiguous at apex. Microreticulation obsolete or very faint on discs of pronotum and elytra, body shiny.

Pronotum with lateral bead narrow; posterolateral angle more or less right angled; basal margin strongly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect slightly arcuate. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternal process with prominence and file well developed, blade narrow and elongate, acute apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male protibia width = 0.22 mm, protarsal ratio = 0.80: 0.88: 0.72 (Fig. 80D); protarsomere 1 with 2 pairs and protarsomere 2 with one pair of scales beneath; anterior protarsal claw (Fig. 80C) shorter and more curved than posterior claw. Aedeagus (Fig. 80E, F) elongate and more or less straight apically in lateral aspect; slightly constricted medially in dorsal aspect.

Ecology. This species is common in mountain streams of desert regions of the southwestern United States. Specimens have been collected from small, isolated pools along drying stream beds and in quiet depositional areas of headwater streams, where they occur among plant debris and fallen leaves.

Distribution. The range extends from Washington State to California and New Mexico.

Hydroporus puberulus-group

Figs. 81 – 83

Small species, length = 2.8 to 3.6 mm; body relatively elongate, subparallel to ovoid, outline discontinuous with hind angles of pronotum somewhat rounded; color dark; microsculpture relatively coarse; pronotum with lateral bead very narrow, partly obsolete on some specimens; elytron in lateral aspect with lateral margin strongly ascendant and epipleuron visible to or almost to shoulder; protibia with a single row of setae on anterior face; tarsi and protarsal claws relatively large.

This is a group of small species which occur in arctic, boreal and alpine portions of the Holarctic region. Three species occur in North America, *H. rufinasus* is Nearctic whereas *H. morio* and *H. puberulus* are Holarctic. Nilsson and Holmen (1995) assigned *H. morio* to the *nigellus*-group but admitted that both the *nigellus*- and *puberulus*-groups were poorly delimited.

24. *Hydroporus rufinasus* Mannerheim 1852

Fig. 81

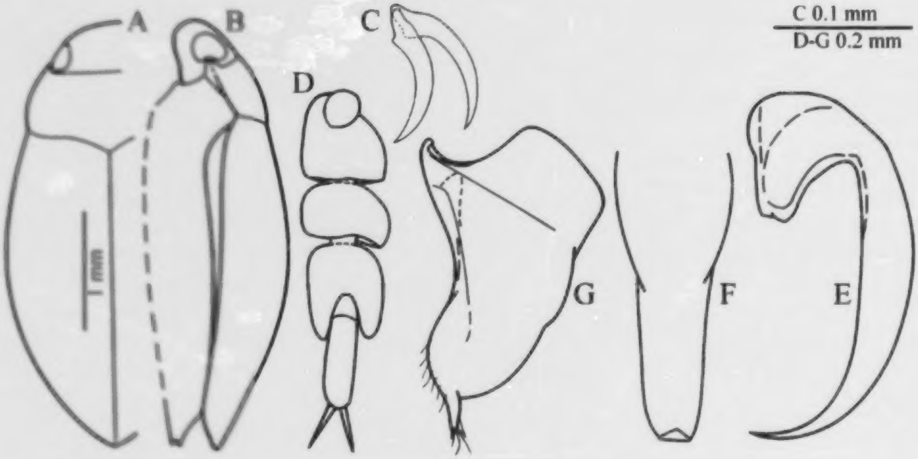


Fig. 81. *Hydroporus rufinasus* Mannerheim. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral. G - paramere.

Hydroporus rufinasus Mannerheim 1852: 305. Type locality - Sitka, Alaska. A syntype is deposited in UMHF (Biström 1987). Type not examined.

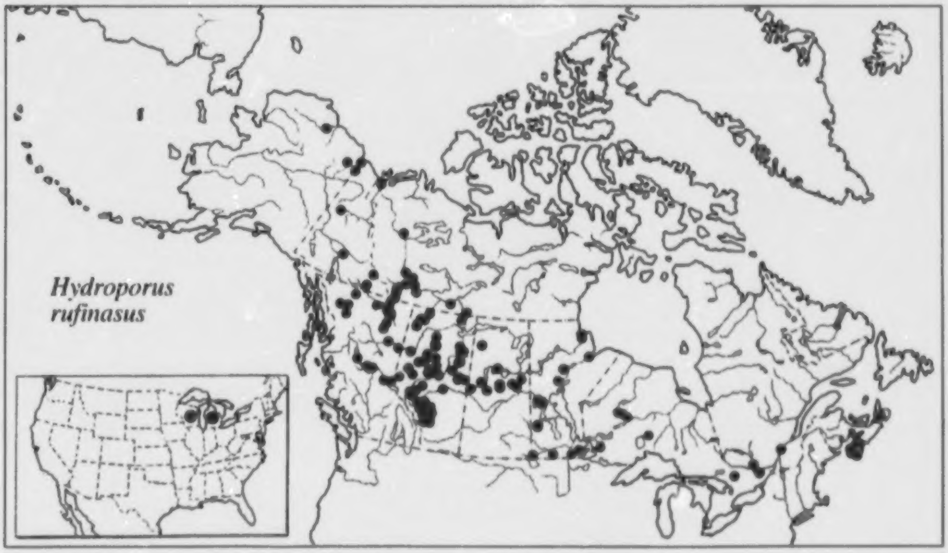
Selected References. Fall 1923: 96; Larson 1975: 303; Hilsenhoff 1995: 13.

Description. Length = 2.9 to 3.2 mm, width = 1.3 to 1.5 mm, length: width = 2.03 to 2.18. Body (Fig. 81A, B) elongate, widest at about two-thirds of length and rounded posteriorly. Pronotum with posterolateral angles strongly rounded, lateral margin more arcuate than that of elytron and therefore lateral outline of body discontinuous in dorsal aspect.

Color reddish brown to piceous with darker black pronotum. Head dorsally dark brown to piceous except for a transverse bar between hind margins of eyes, and a large bright red triangular area covering clypeus and frons between frontal fovea; head ventrally reddish; antenna with antennomeres 1 and 2 red, outer antennomeres piceous apically; palpi pale, apical palpomeres largely infuscate. Pronotum black except anterolateral angle and lateral margin piceous. Elytron reddish or brownish basally and laterally, darkened to piceous medially and apically; epipleuron reddish. Ventral surface largely black but propleuron and proepisternum reddish to piceous. Legs reddish with base of metafemur, tibia apically and tarsi, darkened.

Head with small sparse punctures. Pronotum punctate over entire disc, medially punctures large and sparse; punctures somewhat larger and denser posteriorly and posterolaterally. Elytron with punctures coarse and about equal in size to those on disc of pronotum, punctures separated by about one and one half to two times their own diameter, each bearing a pale brown seta slightly longer than distance between punctures; epipleuron finely and sparsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum; metacoxal plate with punctures separated by about one to two times their own diameter, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures moderately dense but separate. Microreticulation evident over all of dorsal surface, sculpture more deeply impressed and more or less granular or matte on some females.

Pronotum with lateral bead very narrow, well delimited along anterior half but obsolete posteriorly; posterolateral angle broadly rounded, obtuse; basal margin almost straight on each side of posteromedial lobe; lateral margin in lateral aspect straight or faintly curved up on anterolateral angle and at most narrowly exposing epipleuron. Elytron with lateral margin strongly ascendant in lateral aspect, epipleuron visible almost to shoulder. Prosternum inflated and rugose along anterior margin, flat at base of process; process with file obsolete or consisting of a few irregular transverse rugae;



Map 98. ***Hydroporus rufinasus*** **Mannerheim. Canadian and Alaskan collection localities and United States state records.**

prominence obsolete, broadly obtuse in lateral aspect; blade broad and short, pointed apically. Metasternum and metacoxae in lateral aspect with midline very slightly concave. Protibia with a single row of punctures on anterior face. Metacoxal processes conjointly with hind margin truncate to very slightly angulate and shallowly protruding.

Male protibia width = 0.14 mm, protarsal ratio = 0.88: 0.94: 0.81 (Fig. 81D); protarsomere 1 with two pairs of large scales, such scales absent from protarsomere 2; protarsal claws (Fig. 81C) not evidently modified. Aedeagus (Fig. 81E, F) with apex strongly arcuate apically in lateral aspect, in dorsal aspect narrowed medially then apex subparallel.

Ecology. The beetles occur in small pools among dense emergent vegetation. They are frequently found in association with sphagnum.

Distribution. Map 98. The range extends from Nova Scotia to Alaska, primarily in the boreal zone.

25. *Hydroporus puberulus* LeConte 1850

Fig. 82

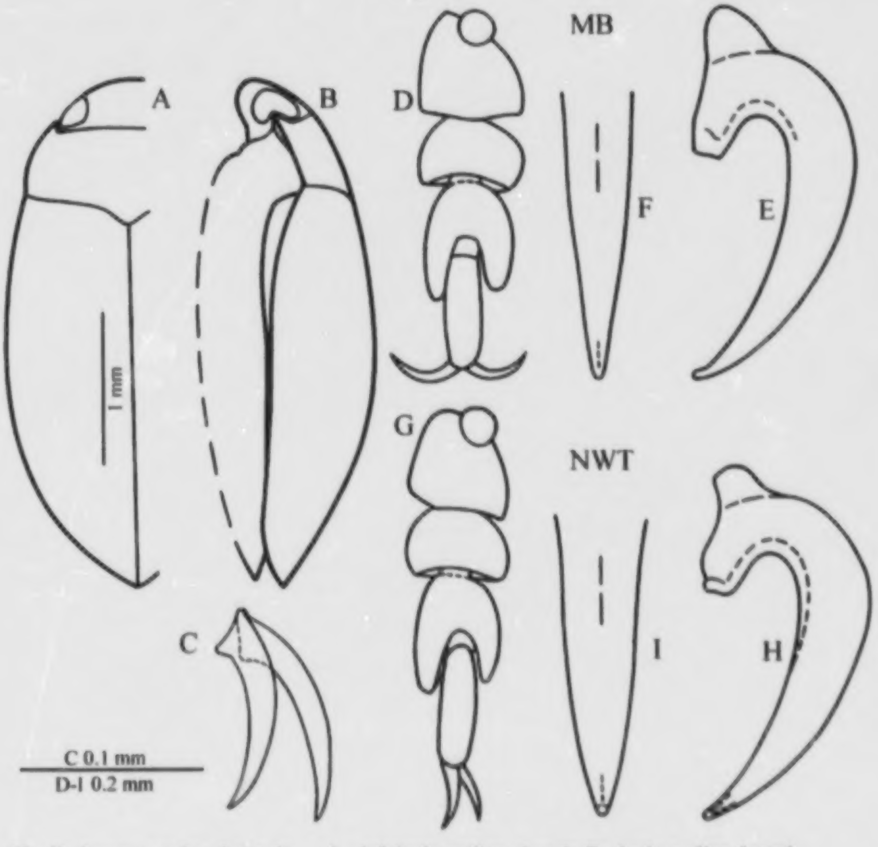


Fig. 82. *Hydroporus puberulus* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsal claws, anterior. D - protarsus, dorsal. E,H - aedeagus, lateral. F,I - aedeagus apex, ventral. Manitoba and Northwest Territory specimens.

Hydroporus glabriusculus; [North American references only] Fall 1923: 95. Hatch 1953: 209. Zaitzev 1953: 156. Larson 1975: 303. Not Aubé 1836.

Hydroporus puberulus LeConte 1850: 215. Lectotype, male in MCZC, labelled: [pin with intact pale blue disc indicating type locality of Lake Superior]/ 3398/ Type 6024/ *H. puberulus* Lec./ J. LECONTE COLLECTION/ LECTOTYPE *Hydroporus puberulus* LeConte 1850 des. Nilsson 1985/ *Hydroporus puberulus* LeC. det. A. Nilsson -85. Type examined.

Hydroporus levanderi J. Sahlberg 1888: 221. Lectotype, female in MZHF, designated by Huggert (1974: 148). Type not examined.

Selected References. LeConte 1855: 292; Sharp 1882*a*: 807; Nilsson and Larson 1984: 123; Hilsenhoff 1995: 12–13; Nilsson and Holmen 1995: 61 – 62.

Description. Length = 2.8 to 3.2 mm, width = 1.4 to 1.6 mm, length: width = 2.00 to 2.13. Body (Fig. 82A, B) elongate, elytron with sides rounded, maximum width at or slightly behind middle and rounded posteriorly. Pronotum with posterolateral angles obtuse, lateral margin more arcuate than that of elytron and therefore lateral outline discontinuous in dorsal aspect.

Color piceous to black. Head dorsally black except frontal bar and anterior margin of clypeus, reddish; head ventrally reddish to rufopiceous with gula paler than genae; antenna with antennomeres 1 to 4 or 5 mainly pale, outer antennomeres mainly black; palpi yellow except apical palpomere of each palpus mainly piceous. Pronotum black except anterolateral angle and lateral margin of some specimens narrowly piceous. Elytron piceous to black or some specimens with lateral and apical portions of disc faintly rufescent or piceous; epipleuron reddish to piceous. Ventral surface mainly black. Legs reddish to rufopiceous, pro- and mesofemur of many specimens distinctly paler than rest of legs.

Head with small, deep punctures, punctures sparse but coarser and denser between frontal impressions. Pronotum medially punctate, punctures larger and denser but separate towards margins. Elytron with punctures coarse, about equal to those on base of pronotum, separated by about one and one half to two times their own diameter, each bearing a yellowish seta, seta about one and one half times as long as distance between punctures; epipleuron sparsely, coarsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally with widely spaced coarse punctures; metacoxal plate laterally with punctures separated by about one to one and one half times their own diameter, mesally more widely spaced; sternum 5 with punctures small but deep, sparsely but evenly distributed over apical half. Microreticulation evident over dorsal surface, meshes on elytron relatively large and somewhat irregular in size and shape; males somewhat shiny, females with lines more deeply impressed and body duller.

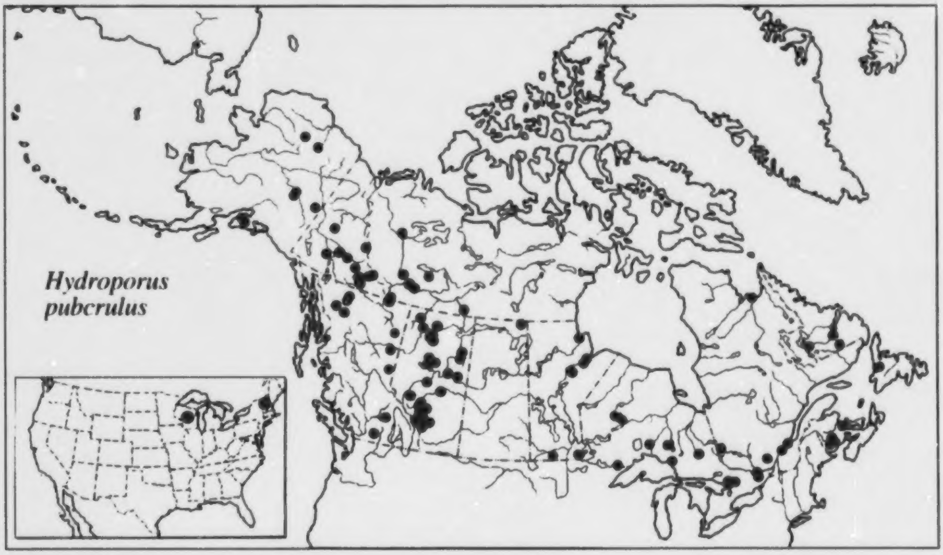
Pronotum with lateral bead very narrow, traceable along anterior half but on many specimens obsolete behind; posterolateral angle obtuse; basal margin almost straight to shallowly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron. Elytron with lateral margin ascendant in lateral aspect, epipleuron visible to or almost to shoulder. Prosternum somewhat inflated and rugose anteriorly, flat medially and without trace of medial convexity; process with prominence in lateral aspect very low but discernible as an obtuse angulation, file reduced, absent or with only a few irregular transverse rugae; blade narrow, bluntly pointed apically. Midline of metasternum and metacoxae in lateral aspect more or less straight. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male protibia width = 0.14 mm, protarsal ratio = 0.80: 0.75: 0.63 (Fig. 82D, G); protarsomeres 1 with two, and protarsomere 2 with one pair of oval scales beneath; protarsal claws (Fig. 82C) only slightly modified, anterior claw slightly broader than posterior. Aedeagus (Fig. 82E, F, I, H) simple, evenly narrowed to apex in ventral aspect; apex with a small rounded knob in lateral aspect.

Comments. Slight variation was noted in the width of the male protarsus and in the width and apical curvature of the aedeagus, e.g., Fig. 82, E, F (Manitoba) compared with I, H (Northwest Territories).

Ecology. Adults have been collected from small pools where the water is cool, such as small pools in bogs or habitats where the water is densely shaded by *Carex*. In the southern Yukon, the species was found to be very abundant in small, artificial pools, such as formed by construction along the edges of roads, on exposed peaty soils. Nilsson and Holmen (1995) described the principal Fennoscandian habitat as semipermanent forest ponds with some sphagnum or *Polytrichum* mosses. The mature larva was described by Nilsson (1989*b)* based on European material and all instars were described by Alarie (1991) based on Nearctic material.

Distribution. Map 99. This species is Holarctic. In North America it occurs in the boreal zone, from western Newfoundland to Alaska.



Map 99. ***Hydroporus puberulus*** **LeConte. Canadian and Alaskan collection localities and United States state records.**

26. *Hydroporus morio* Aubé 1838

Fig. 83

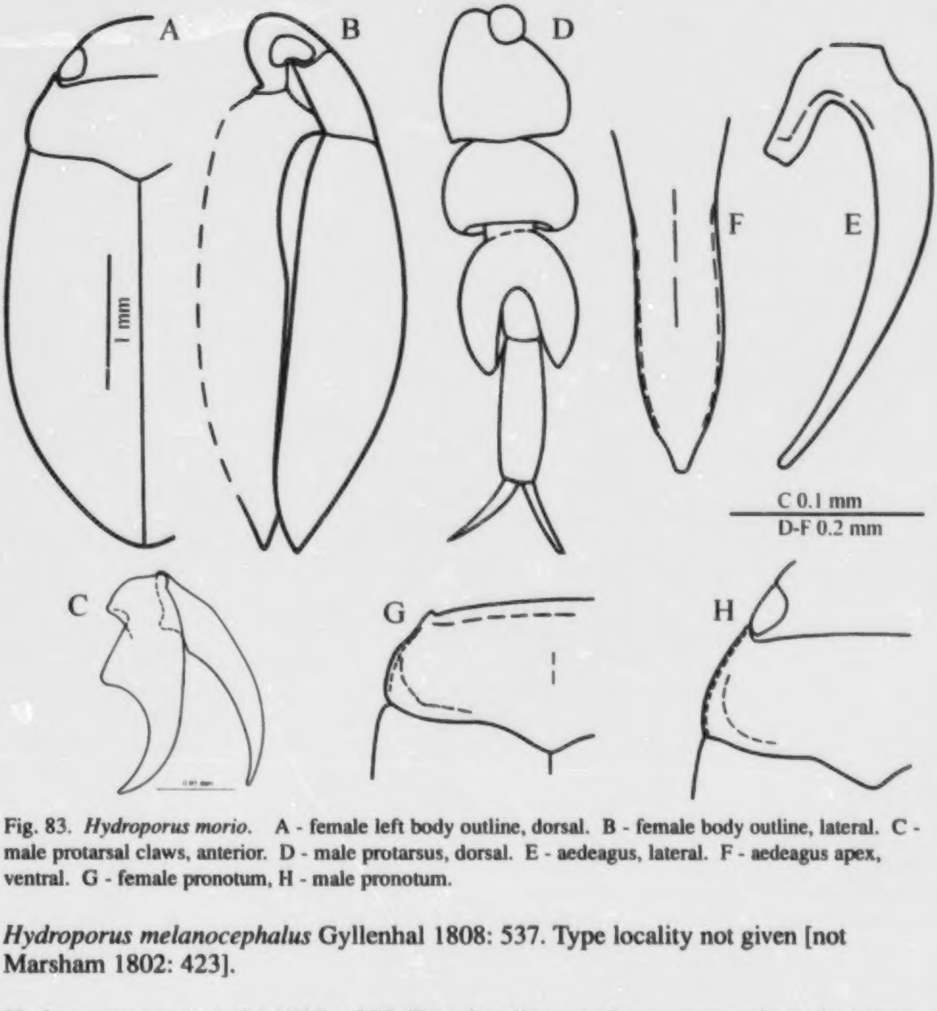


Fig. 83. *Hydroporus morio*. A - female left body outline, dorsal. B - female body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral. G - female pronotum, H - male pronotum.

Hydroporus melanocephalus Gyllenhal 1808: 537. Type locality not given [not Marsham 1802: 423].

Hydroporus morio Aubé 1838*a*: 307. Type locality not given, apparently no lectotype has been designated. Type not examined.

Hydroporus caliginosus LeConte 1850: 215. Type, female in MCZC, on pin with pale blue disc with two cuts; MCZC type 6025. Type examined.

Selected References. LeConte 1855: 292; Crotch 1873: 395; Sharp 1882*a*: 471, 789; Wickham 1895: 76; Fall 1923: 91; Balfour-Browne 1940: 298; Gordon and Post 1965: 18; Larson 1975: 304 – 305; Jeppeson 1986: 67 – 79; Böcher 1988: 15; Hilsenhoff 1995: 11; Nilsson and Holmen 1995: 57 – 58.

Description. Length = 3.0 to 3.6 mm, width = 1.5 to 1.8 mm, length: width = 1.91 to 2.11. Body (Fig. 83A, B) subparallel to ovoid, some females widest in posterior third, most males widest at middle and rounded posteriorly. Pronotum with posterolateral angles relatively broadly rounded, lateral margin more arcuate than that of elytron and therefore lateral outline of body slightly discontinuous in dorsal aspect.

Color black. Head dorsally mainly piceous to black except frontal bar between eyes and anterior margin of clypeus, reddish; head ventrally dark reddish, genae of many specimens darker than gula. Antenna pale basally, antennomeres 2 or 3 to 11 progressively darkened apically; palpi reddish except apical palpomere darkened apically. Pronotum black with anterolateral angle and lateral margin vaguely piceous. Elytron black medially, most specimens rufescent laterally; epipleuron dark reddish basally, darkened apically. Ventral surface mainly black. Legs reddish with femora basally, tibia and tarsi infuscate.

Head with punctures small and deep, sparse, densest between eyes and in frontal impressions. Pronotum punctate over entire disc, medially punctures smaller and sparser. Elytron with punctures coarse and deep, separated by about one and one half to two times their own diameter, each bearing a silvery seta, seta about one and one half to two times distance between punctures; epipleuron sparsely and coarsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally with punctation various, some specimens with punctures relatively small and sparse, others with coarse more or less regular punctation; metacoxal plate of coarsely punctate specimens with punctures deep, large and dense, separated by about one and one half to two times their own diameter, equal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures fine, shallow and sparse. Microreticulation of dorsal surface coarse; pronotum with meshes coarse laterally and basally, medially with lines shallower and meshes slightly transverse (faintly on male, more distinctly on female); male elytron with meshes large, flat and irregular in shape but not distinctly transverse, surface shiny; many females with surface duller, lines dense and deeply impressed, meshes smaller than on male and on some specimens more or less transverse.

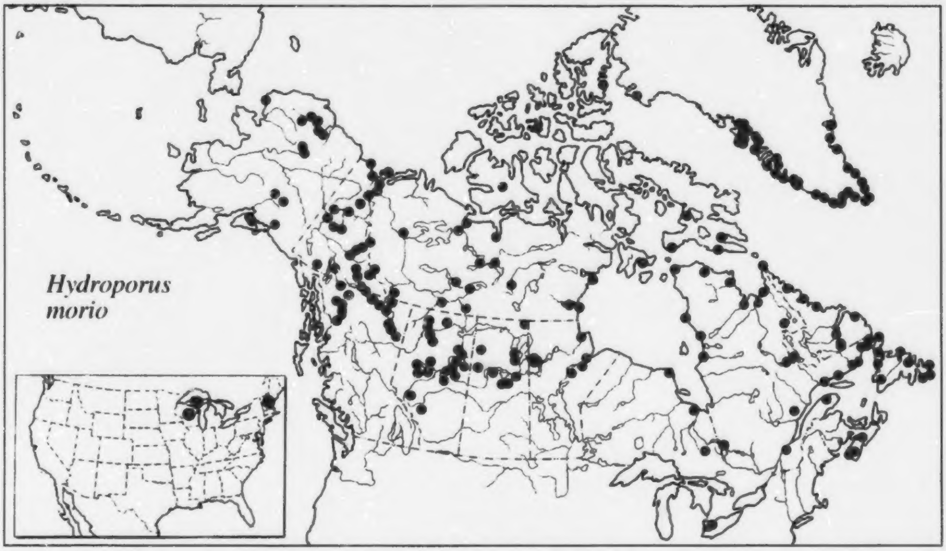
Pronotum with lateral bead narrow and poorly defined throughout most of length, many females with side of pronotum straight or slightly impressed and sinuate posterior to anterolateral angle (Fig. 83G), males with lateral margin of pronotum more evenly rounded (Fig. 83H); disc of pronotum with a transverse impression on posterolateral corner delimiting discal convexity; posterolateral angle obtuse; basal margin slightly and broadly convex on each side of posteromedial lobe; lateral margin in lateral aspect slightly to distinctly reflexed on anterolateral angle and exposing epipleuron. Elytron with lateral margin ascendant in lateral aspect, epipleuron of most specimens not visible but on some specimens visible to shoulder. Prosternum flat at base of process; process with prominence evident but broadly obtuse in lateral aspect, file with transverse rugae fine or obsolete, blade bluntly pointed apically, medial convexity relatively low. Metasternum and metacoxae in lateral aspect with midline straight. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate. Pro- and mesotarsi of both sexes relatively large.

Male protibia width = 0.16; protarsal ratio = 0.75: 0.80: 0.74 (Fig. 83D); tarsomeres 1 and 2 with two and one pairs of oval scales on ventral surfaces, respectively; anterior protarsal claw (Fig. 83C) with a broad ventral tooth. Aedeagus (Fig. 83E, F) simple, slender in lateral aspect; in dorsal aspect with a slight lateral sinuation near middle and with apex slightly produced as rounded knob.

Comments. The confused taxonomic history of this species was summarized by Larson (1975). In addition to this is the observation of Alarie (1991) that larval Nearctic specimens possess natatory setae on the tarsi whereas Palaearctic larvae (Nilsson 1989*b)* lack such setae, suggesting that additional unrecognized taxa may exist.

Ecology. This species occurs in small pools with peaty substrates, mossy banks and no to dense emergent sedges or rushes. Water temperatures in many such pools are low. The species has been found in open pools in alpine and tundra habitats, as well as in small pools in black spruce – sphagnum bogs. The larva has been described numerous times by European authors and Nearctic larval stages were redescribed by Alarie (1991).

Distribution. Map 100. The range is Holarctic in the boreal and arctic zones. This is one of the two species of Dytiscidae to occur on Greenland.



Map 100. *Hydroporus morio* Aubé. Canadian and Alaskan collection localities and United States state records.

Hydroporus tristis-group

Fig. 84

Small to moderate sized, Nearctic specimens length = 2.8 to 3.2 mm; body elongate-oval to subparallel shape, pronotum and elytra continuous or slightly discontinuous in outline; color dark reddish brown to black; dorsal surface microreticulate; pronotum with lateral bead narrow; elytron with lateral margin strongly ascendant; prosternum medially with a short convex ridge extending forwards from base of process; protibia with a single medial row of setae on anterior face.

This group contains one Palaearctic and one Holarctic species.

27. *Hydroporus tristis* (Paykull 1798)

Fig. 84

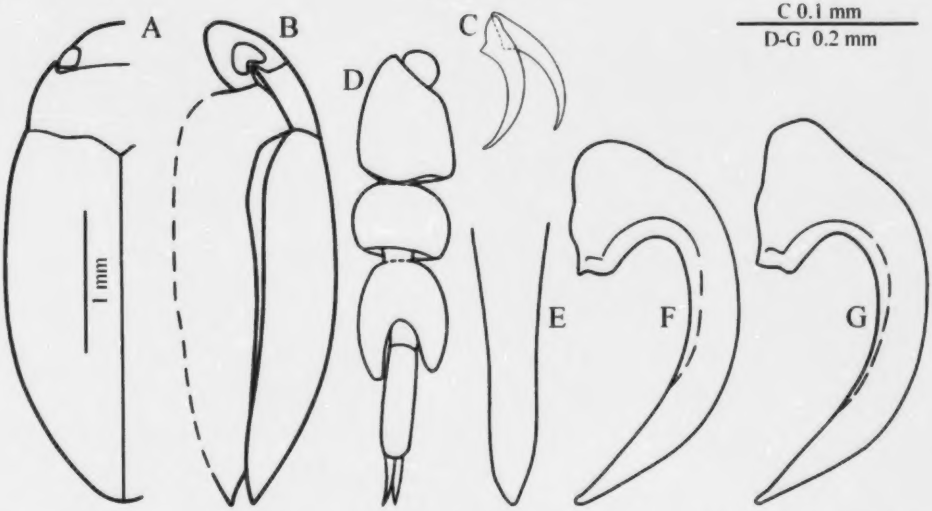


Fig. 84. *Hydroporus tristis* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsal claws, anterior. D - protarsus, dorsal. E - aedeagus apex, ventral. F,G - aedeagus, lateral

Dytiscus tristis Paykull 1798: 232. Type locality not given; type in Swedish Museum of Natural History, Stockholm. Type not examined.

Hydroporus varians LeConte 1850: 215. **LECTOTYPE**, here designated, female in MCZC, labelled: pale blue disc with two cuts [indicating type locality of Lake Superior]/ *H. varians* Lec./ Type 6027/ *H. tristis* Payk/ J.L. LeConte Collection/ LECTOTYPE *Hydroporus varians* LeConte des. Larson and Roughley. Type and two syntypes in MCZC examined.

Hydroporus ruficapillus Mannerheim 1852: 304. Type locality given as "In palude prope Nov. Archangelsk frequens". There is a male specimen in LeConte Collection, MCZC, labelled "Type 7406/ *H. ruficapillus* Mannh. Sitka" which was sent by Mannerheim to LeConte. There are 24 syntypes in UMHF (Biström 1987: 37).

Selected References. LeConte 1855: 292; Crotch 1873: 395; Sharp 1882*a*: 472; Wickham 1895: 76; Fall 1923: 97; Hatch 1953: 210; Zaitzev 1953: 155; Larson 1975: 305 – 306; Hilsenhoff 1995: 15; Nilsson and Holmen 1995: 63 – 64.

Description. Length = 2.8 to 3.2 mm, width = 1.4 to 1.5 mm, length: width = 2.03 to 2.17. Body (Fig. 84A, B) narrowly elongate-oval, widest at middle and rounded posteriorly; lateral outline slightly to distinctly discontinuous in dorsal aspect due to rather strongly rounded lateral margins of pronotum.

Color reddish brown with pronotum black, elytra of many specimens with darker medial cloud. Head dorsally reddish with a piceous spot mesad to each eye, and laterally posterior to eye, piceous (some specimens with these piceous spots broadly expanded and covering most of posterodorsal surface of head); head ventrally reddish or with genae darker than gula; antenna reddish basally, antennomeres 2 or 3 to 11 infuscate apically; palpi reddish with apical palpomere of each palpus infuscate apically. Pronotum black and on most specimens contrasting in color with head and base of elytra, anterolateral angle and lateral margin narrowly reddish or piceous. Elytron brownish or reddish laterally and basally, gradually darkened to piceous medially and apically; epipleuron reddish. Ventral surface mainly black with prosternal process, metacoxal processes and posterior margins of sterna 3 to 6, reddish or piceous. Legs reddish with tarsi infuscate.

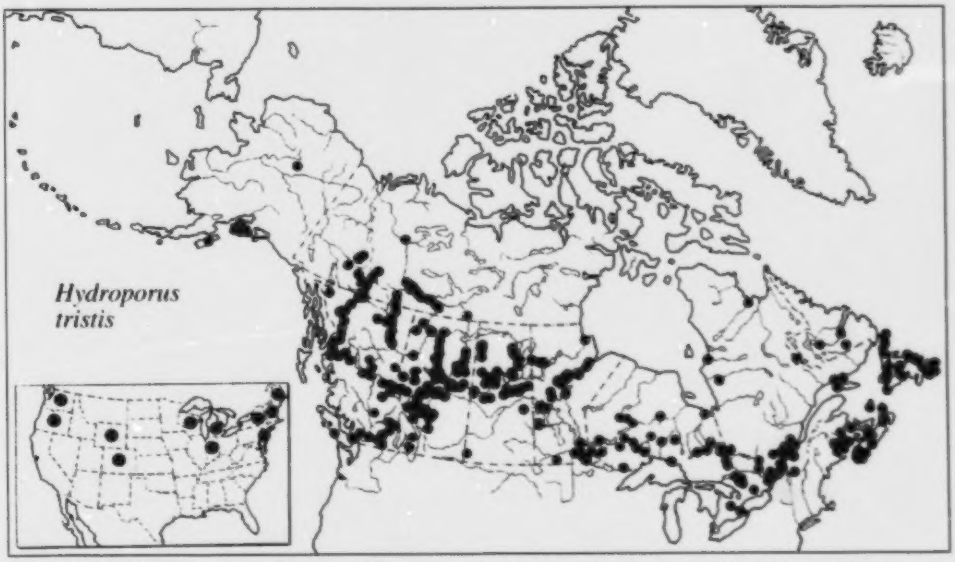
Head with punctures small but distinct, densest medially on clypeus and between hind margins of frontal impressions. Pronotum punctate over entire disc, medially punctures rather small and sparse, punctures distinctly larger anteriorly and posteriorly, denser laterally and almost confluent. Elytron with punctures small but deep, somewhat larger than those on disc of pronotum, punctures separated by two to three times their own diameter, each bearing a fine yellowish seta about one to one and one half times as long as distance between punctures; epipleuron with punctures small and sparse. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate; metacoxal plate with punctures deep, small and sparse, punctures separated by about two times their own diameter; sternum 6 with punctures very small and sparse. Microreticulation present on dorsal surface, metacoxal plates and sterna; some specimens with lines shallowly impressed on pronotum and elytra and body somewhat shiny.

Pronotum with lateral bead complete but narrow; disc convex, somewhat inflated laterally, convexity clearly delimited towards hind angle by an oblique series of punctures; posterolateral angle obtuse; basal margin shallowly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron. Elytron with lateral margin strongly ascendant in lateral aspect, epipleuron visible almost to shoulder. Prosternum with a low medial convexity extending anteriorly from base of process onto medial impression to or almost to anterior margin, prosternum laterally with impressed area delimited by oblique ridges running anteromedially from anterior margin of procoxal cavity; prominence and file well developed; blade of process narrow and elongate, bluntly pointed apically. Protibia with a single row of punctures on anterior face but this row interrupted or sinuate medially on most specimens. Metacoxal process conjointly with hind margin shallowly protruding and shallowly sinuate on either side of midline.

Male protibia width = 0.15; protarsal ratio = 0.81: 0.75: 0.69 (Fig. 84D); protarsomere 3 rather elongate and asymmetrical with posterior lobe slightly longer than anterior; tarsomeres 1 and 2 with three (sometimes two) and two pairs of small adhesive scales on ventral surface, respectively; anterior claw (Fig. 84C) slightly broader than posterior claw in lateral aspect. Aedeagus (Fig. 84E – G) arcuate in lateral aspect, apex with a very slight ventral reflexion.

Ecology. This is a common species that occurs in a variety of lentic habitats. Specimens are usually found among dense emergent vegetation at the margin of small, often more or less shaded, pools. The insects are also common in small peatland pools. Nilsson (1989*b)* described the mature larva based on European specimens and Alarie (1991) described all larval instars based on Nearctic specimens.

Distribution. Map 101. The species occurs across Eurasia, from Britain to Siberia. The North American range extends from Newfoundland and New Jersey west to Alaska and Oregon, primarily in forested regions but there are a few records from arctic localities. It does not occur on the prairies.



Map 101. *Hydroporus tristis* (Paykull). Canadian and Alaskan collection localities and United States state records.

Hydroporus fuscipennis-group

Figs. 85 – 87

Small size, length = 2.7 to 3.5 mm; body outline smoothly oval, continuous; color dark brown to black; microreticulation of many specimens reduced or absent; pronotum with lateral bead strong; elytron with lateral margin ascendant but epipleuron not visible to shoulder; prosternum with base of prosternal process not prolonged anteriorly as a low convex ridge, protibia with either a single longitudinal row of punctures or with coarse punctures arranged in two rows or irregularly distributed, male protarsal claws slightly to strongly bent basally and intralinear space of metacoxae with dense punctation and on many specimens a dense brush of setae.

This Holarctic group contains three arctic and boreal species in North America. The species *H. fuscipennis* and *H. polaris* are clearly related for they share the coarse, irregular punctation of the anterior face of the protibia and the males have the intralinear space on the metacoxae densely punctate and setose. However, *H. larsoni* lacks these characters and we associate it with *H. fuscipennis* primarily on the basis of the reduced microreticulation. Possibly its affinities lie with the *H. striola*-group but there are no synapomorphic characters to support this.

28. *Hydroporus fuscipennis* Schaum 1868

Fig. 85

Hydroporus fuscipennis Schaum 1868: 64. No type locality given; Schaum's types reported to be in the Zoological Museum, Munich, Germany. Type not examined.

Hydroporus puberulus Mannerheim 1853: 163, not LeConte 1850. Type locality given as Kaktnu R., Kenai Penninsula; a male in LeConte Collection, MCZC, labelled "Type 7405/ *Hydroporus puberulus* Mannh. Kenai" is probably a specimen sent by

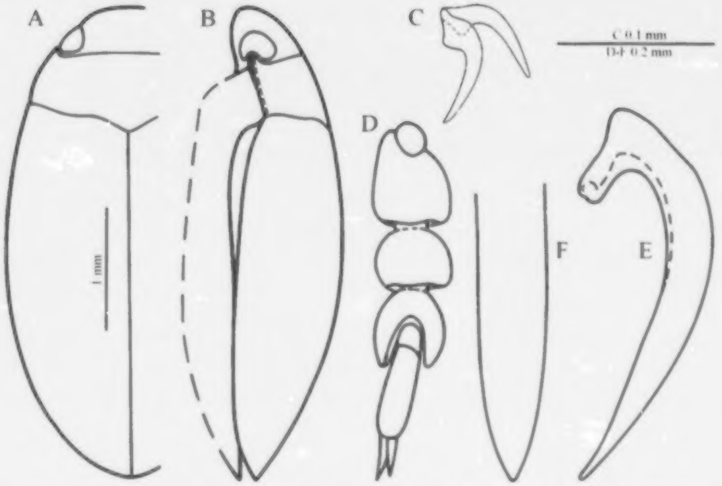


Fig. 85. *Hydroporus fuscipennis* Schaum. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Mannerheim to LeConte. Biström (1987) states that four syntypes are deposited in ZMHF. MCZC specimen examined.

Hydroporus criniticoxis Larson 1975: 301. Holotype - male in CNC, labelled: Alta. (Alberta) 0.5 mi. e Brownvale, 18.VII.70, D. and M. Larson/ Holotype *Hydroporus criniticoxis* Larson 1975, CNC No. 15029. Specimen examined.

Selected references. Zimmermann 1919: 176; Fall 1923: 93; Hatch 1953: 208; Zaitzev 1953: 166; Anderson 1962: 63; Gordon and Post 1965: 18; Nilsson and Larson 1985: 123; Hilsenhoff 1995: 10; Nilsson and Holmen 1995: 50 – 51.

Description. Length = 2.9 to 3.5 mm, width = 1.4 to 1.8 mm, length: width = 1.93 to 2.09. Body (Fig. 85A, B) broadly oval, widest at middle and broadly rounded posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown to piceous with pronotum black. Head dorsally black except anterior margin of clypeus and a transverse bar between eyes, dark reddish or piceous; head ventrally with genae piceous to black, gula reddish; antenna pale basally, antennomeres 5 to 11 piceous apically; palpi pale except terminal palpomere of each palpus infuscate apically. Pronotum black except lateral margin narrowly piceous. Elytron rufopiceous to piceous; epipleuron rufopiceous. Ventral surface mainly black with apex of metacoxal processes and hind margin of sterna 3 to 6, piceous. Legs reddish to piceous.

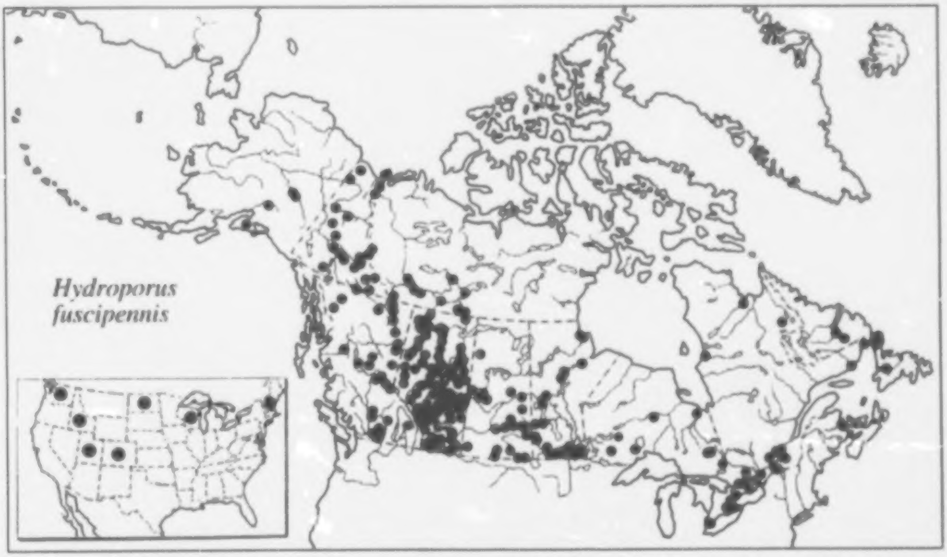
Head with sparse, distinct punctures. Pronotum medially with punctures small, sparse and of more or less uniform size; punctures larger towards margins, somewhat longitudinally confluent on posterolateral angle. Elytron with punctures coarser than those on disc of pronotum, punctures separated by one to one and one half times their own diameter, each bearing a yellowish seta, seta one and one half times longer than distance between punctures; epipleuron distinctly punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally with more or less evenly spaced, moderate sized punctures separated by about their own diameter; sternum 6 with punctures deep and crowded along hind margin. Microreticulation of head shallow but distinct;

pronotum with disc medially smooth and shiny between punctures, laterally towards margin sculpture evident; elytron of males and most females basomedially devoid of sculpture but sculpture present towards apex (some females with entire surface lightly microreticulate). Metacoxal plate and abdominal sterna shiny without microreticulation, or with lightly impressed lines on some females.

Pronotum with lateral bead rather broad, sharply delimited and somewhat elevated; posterolateral angle more or less right angled; basal margin shallowly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum with file well developed, prominence low but evident; process with blade narrow, bluntly pointed apically. Protibia anterior face with an irregular double row of punctures or with irregularly scattered coarse punctures. Metacoxal process conjointly with hind margin truncate or very slightly angulate medially.

Male protibia width = 0.14 mm, protarsal ratio = 0.71: 0.71: 0.59 (Fig. 85D); tarsomere 1 bearing four to five and tarsomere 2 bearing one or two pairs of small oval scales on ventral surface; protarsal claws (Fig. 85C) strongly arcuate basally, anterior slightly longer and broader than posterior. Metacoxae with intralinear space densely punctate and bearing suberect golden or pale brown setae, best seen in lateral aspect. Aedeagus (Fig. 85E, F) in dorsal aspect subparallel with shortly pointed apex.

Comments. As noted by Nilsson and Larson (1985), *H. criniticoxis* is a junior synonym of *H. fuscipennis*. *Hydroporus criniticoxis* was described primarily on the basis its possession of a dense brush of setae in the intralinear space of the metacoxae of the male. This character also exists on Palaearctic specimens but had never been described in the literature, no doubt because of the usual way Europeans mount specimens by glueing them onto cards so that characters of the ventral surface are hidden. The name, *H. puberulus* Mannerheim is older than *H. fuscipennis* but the former is unavailable because of homonymy.



Map 102. *Hydroporus fuscipennis* Schaum. Canadian and Alaskan collection localities and United States state records.

Ecology. The beetles occur among dense emergent vegetation along the margins of small, often temporary pools, usually situated in grasslands, cleared areas or at the edges of forest, but not typically in forest pools. The insects are usually in more or less eutrophic pools and are not common in peatlands. The mature larva was described by Nilsson and Carr (1989) based on European specimens and first, second and third instar larvae were described by Alarie (1991) based on Nearctic specimens.

Distribution. Map 102. This is a Holarctic species of very wide distribution. In North America it occurs from Newfoundland to Alaska and from the southern limits of the low arctic into the New England States, the northern Great Plains and along the Rocky Mountains.

29. *Hydroporus polaris* Fall 1923

Fig. 86A – F

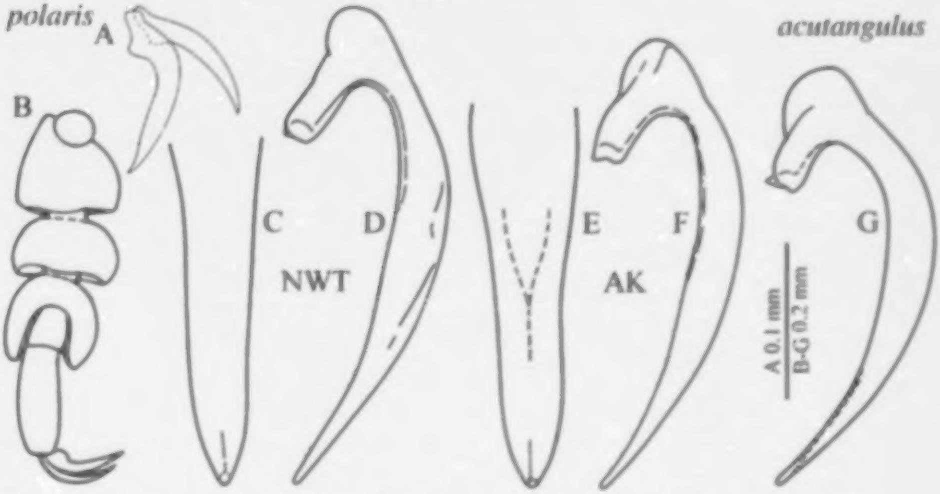


Fig. 86. *Hydroporus male*. A – F - *H. polaris*. A - protarsal claws, anterior. B - protarsus. C,E - aedeagus apex, ventral. D,F - aedeagus, lateral. G – H - *H. acutangulus* aedeagus, lateral.

Hydroporus polaris Fall 1923: 92. Holotype - male in CNC labelled as follows: Bernard Harbour, NWT, May 25, Canadian Arctic Expedition, F[ritz] J[ohansen], 1916/ 1627/ HOLOTYPE, *Hydroporus polaris* Fall, CNC No. 20867 (red label). Type examined. A paratype female from the same locality except "July" is in CNC (No. 20867). A paratype female in MCZC, Paratype 23948, has the same data as the holotype.

Hydroporus subvirescens Fall 1923: 92. Holotype - male in CNC labelled follows: Cape Collinson, Sept. 22, Alaska/ Canadian Arctic Expedition, F[ritz] J[ohansen], 1913/ 1717/ HOLOTYPE, *Hydroporus subvirescens* Fall, CNC No. 20868 (red label). Type examined. A male paratype (MCZC Paratype 23958) from the same locality was examined. Three female specimens with the same collection data in CNC are not part of the type series. NEW SYNONYMY.

Selected Reference. Nilsson and Holmen 1995: 48.

Description. Length = 2.7 to 3.4 mm, width = 1.4 to 1.8 mm, length: width = 1.86 to 2.00. Body oval, widest behind middle and rounded posteriorly; lateral outline continuous in dorsal aspect.

Color dark brown to black. Head dorsally piceous to black with frontal margin and frontal bar between eyes, reddish; head ventrally reddish or with genae infuscate; antenna with basal antennomeres yellow, apical antennomeres darkened; palpi infuscate apically. Pronotum black except lateral bead and narrow margin mesad to bead, piceous on many specimens. Elytron brown to almost black, paler at base and laterally and gradually darkened medially and apically; epipleuron piceous. Venter mainly black. Legs brown to piceous.

Head with punctures small and sparse. Pronotum medially with punctures very small and sparse, punctures larger towards margins but well separated. Elytron with punctures about equal in size to those on base of pronotum, relatively widely spaced and separated by twice their own diameter, each bearing a yellowish setae about as long as distance between punctures; epipleuron finely and sparsely punctate. Metasternum laterally with a few irregular coarse punctures, metacoxal plate and sterna 1 and 2 laterally finely punctate, metacoxal plate with punctures small and moderately sparse, separated by about twice their own diameter; sternum 6 with punctures fine and sparse, mediobasally more or less impunctate. Microreticulation evident on entire dorsal and ventral surfaces; lightly impressed on many shiny males; many females with sculpture more deeply impressed, appearing duller.

Pronotum with lateral bead well defined, elevated, slightly widened anteriorly on many specimens; posterolateral angle about right angled; basal margin sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron in lateral aspect with lateral margin ascendant, epipleuron not visible to shoulder. Prosternum with prominence in lateral aspect a low obtuse angulation, file irregularly rugose; process with blade narrow and elongate, acute apically. Protibia with two very irregular longitudinal rows of coarse punctures or punctures irregularly scattered over surface. Metacoxa with intralinear space and adjacent area of metasternum very finely and densely punctate and bearing short yellow pubescence on both sexes (setae may be rubbed in which case intralinear space appears finely granular). Metacoxal processes with hind margins conjointly angulate and slightly produced medially.

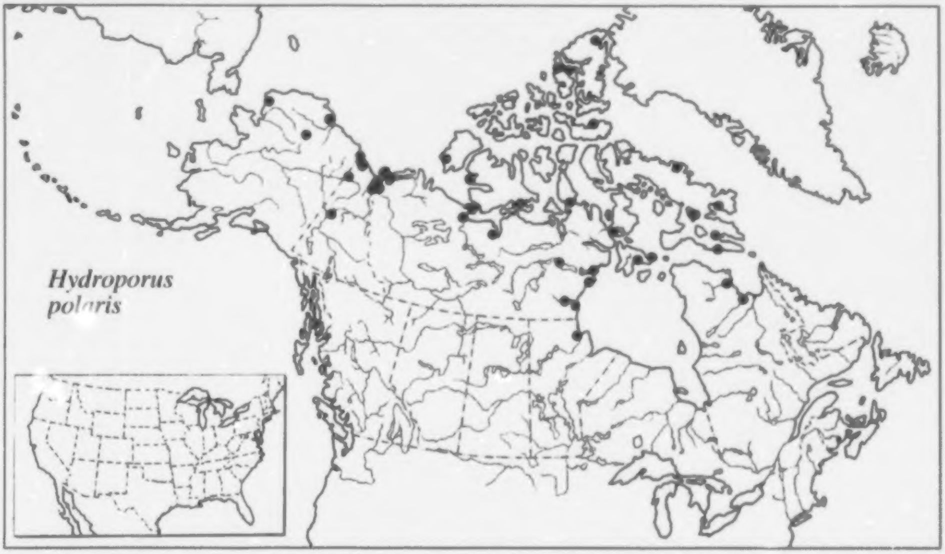
Male protibia width = 0.13 mm; protarsal ratio = 0.88: 0.81: 0.75 (Fig. 86B); anterior protarsal claw (Fig. 86A) slightly broadened and more arcuate basally than posterior. Metatrochanter with hind margin densely punctate and bearing short yellow setae. Aedeagus (Fig. 86C – F) slender, in lateral aspect slightly broadened medially and with a few sparse spicules along ventral margin.

Comments. *Hydroporus subvirescens* is a synonym of *H. polaris*. The elytra of many specimens have a metallic sheen due to the fine sculpture, and some specimens are faintly aeneous. However, the specimens from Cape Collinson, Alaska, are no more so than specimens from elsewhere in the range. The pronotal bead of the Cape Collinson specimens is slightly narrower than in specimens from other populations of *H. polaris*, but is still wider than in most species of *Hydroporus*. The Palaearctic species, *H. acutangulus* Thomson 1854, is very similar and Nilsson (1989*b)* and Nilsson and Holmen (1995) suggested it may be conspecific with *H. polaris*. However, Scandinavian specimens differ from specimens of *H. polaris* as follows: body broader; less coarsely sculptured, microreticulation obsolete on disc of pronotum and base of elytron, and on metacoxal plates of some males; punctation coarser, especially on metacoxal plates and sternum 6; pronotal disc more convex, faint transverse impression more basal; epipleuron more hidden by side of elytron, lateral margin of elytron not so strongly ascendant; aedeagus (Fig. 86G) not so broad medially, ventral spicules less numerous; male anterior protarsal claw similar in shape but more slender. Unless it is shown that these characters vary clinally across northern Asia, the differences are sufficient to justify the recognition of two species.

The larva of *H. polaris* has not been described but is likely to prove very similar to that of *H. acutangulus* (Nilsson 1989*b*).

Ecology. Specimens were taken in the northern Yukon in the narrow cracks around ice polygons and in similar areas without aquatic vegetation but over very dark organic matter.

Distribution. Map 103. This Nearctic species occurs throughout the arctic regions of North America. It is not known from Greenland.



Map 103. *Hydroporus polaris* Fall. Canadian and Alaskan collection localities and United States state records.

30. *Hydroporus larsoni* Nilsson 1984

Fig. 87

Hydroporus fuscipennis Larson 1975: 301 [not Schaum 1868].

Hydroporus larsoni Nilsson 1984: 123 (in Nilsson and Larson 1984) (new name for *H. fuscipennis* Larson). As no type specimen was designated, we here designate as neotype, a male specimen used by Larson (1975) in the diagnosis and description of the species. **NEOTYPE**, here designated, male labelled: [Alberta] 8 mi. w. Calgary, Hwy 1A 8/IV/71, D & M Larson/ NEOTYPE, Hydroporus larsoni Nilsson, desig. Larson & Roughley 1998. Specimen in CNC.

Selected References. Nilsson and Larson 1984: 123; Hilsenhoff 1995: 10 – 11.

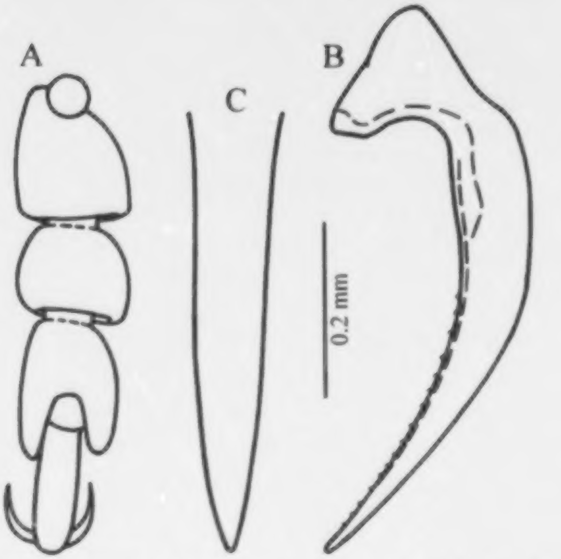


Fig. 87. *Hydroporus* larsoni Nilsson. A - male protarsus, dorsal. B - aedeagus, lateral. C - aedeagus apex, ventral.

Description. Length = 3.0 to 3.3 mm, width = 1.5 to 1.7 mm, length: width = 1.90 to 2.08. Body more or less evenly oval in outline, generally narrower in appearance than *H. fuscipennis*, widest at middle and broadly rounded posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown with pronotum darker. Head dorsally reddish brown to piceous except a transverse reddish fascia between hind margins of eyes and reddish anterior margin of clypeus which is prolonged medially onto frons; head ventrally reddish; antenna and palpi pale basally, infuscate apically. Pronotum piceous medially, lateral margins broadly pale brown to reddish. Elytron with epipleuron and lateral margins brown, darker brown to piceous medially and apically. Ventral surface black with prosternal process, metacoxal process, posterior margins of sterna 3 to 6, and sterna also laterally on some specimens, reddish to piceous. Legs pale brown to reddish.

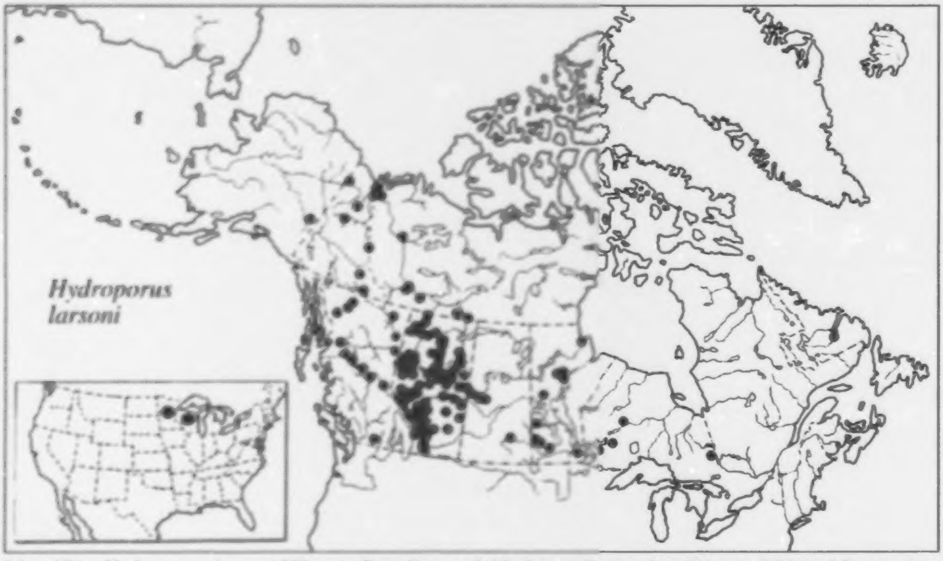
Head with small and relatively sparse punctures, punctures coarser and denser in chevron-shaped area beginning over antennal bases and converging at level of posterior margin of eyes. Pronotum punctate over entire disc, medially punctures smaller, sparser and of irregular size; punctures larger towards margins and somewhat longitudinally confluent on posterolateral angle. Elytron with punctures fine but coarser than those on disc of pronotum, punctures separated by one to one and one half times their own diameter, each bearing a yellowish seta, seta twice as long as distance between punctures; epipleuron more finely punctate. Ventral surface with punctation strong, coarser than in *H. fuscipennis*; metacoxal plate with punctures separated by about one to one and one half times their own diameter; sternum 6 with punctures coarse, irregularly distributed over surface but not crowded towards hind margin. Microreticulation of head fine; pronotum with microreticulation obsolete medially, evident laterally; elytron with microreticulation reduced, obsolete basally and evident only on apical half to third on most specimens (a few females with entire disc lightly sculptured); metacoxal plates and abdominal sterna smooth and polished, microreticulation absent.

Pronotum with lateral bead well delimited but narrower and lower than in *H. fuscipennis*; posterolateral angle more or less right angled; basal margin shallowly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron in lateral aspect with lateral margin ascendant, epipleuron not visible to shoulder. Prosternum with prominence obsolete or represented in lateral aspect by a very low, broad angulation, file evident; process with blade narrow and elongate, acutely rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate; intralinear space with punctures not dense, bearing moderately long decumbent pale setae.

Male protibia width = 0.13 mm, protarsal ratio = 0.71: 0.68: 0.62 (Fig. 87A); protarsomeres 1 and 2 ventrally bearing two and one pair of small oval scales, respectively; protarsal claws slightly arcuate basally, anterior claw very slightly broader and more arcuate basally than posterior. Aedeagus (Fig. 87B, C) slender and narrowly tapered in ventral aspect, in lateral aspect ventral surface with fine spines along midline.

Ecology. Specimens occur in small pools with dense *Carex*. They are most common in forested areas but also occur in the parkland and northern grassland areas of the Great Plains, and into the southern tundra.

Distribution. Map 104. The range of this species extends from Labrador to the Yukon Territory, principally in the boreal and parkland zones.



Map 104. *Hydroporus larsoni* Nilsson. Canadian and Alaskan collection localities and United States state records.

Hydroporus appalachius-group
Figs. 88 – 90

Small size, length = 2.9 to 3.7 mm; body outline elongate oval, continuous; color brown to black, elytron of most specimens with at least humeral angle pale, some specimens with extensive yellow markings; microreticulation present; pronotum with lateral bead strong; elytron with lateral margin ascendant but epipleuron not visible to shoulder; prosternum with base of prosternal process not prolonged anteriorly as a low convex ridge, protibia with a single longitudinal row of punctures, male protarsal claws very slightly modified, protarsomere 1 with two pairs of scales, protarsomere 2 lacking scales, metacoxae with interlinear space sparely punctate and without dense brush of setae.

This group contains three Nearctic species. The group is weakly defined, the principal characters for recognition being small size, elongate-oval shape, the tendency for the elytra to have pale markings, and the habitat which is generally moving water such as seepages and springs, small streams and wave-washed lake shores.

33. *Hydroporus appalachius* Sherman 1913

Fig. 88

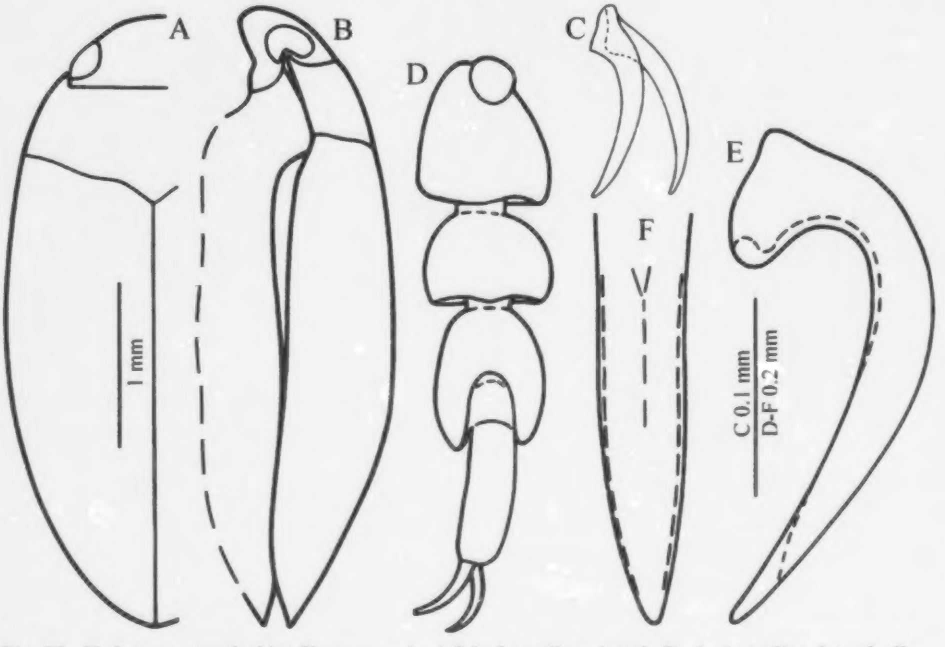


Fig. 88. *Hydroporus* appalachius Sherman. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

Hydroporus signatus Sharp 1882*a*: 469. Type locality - Hermit Lake, Mt. Washington, New Hampshire. Type in BMNH not examined. [Not Mannerheim 1853].

Hydroporus appalachius Sherman 1913: 53. New name for *H. signatus* Sharp.

Hydroporus occidentalis; Gordon and Post 1965: 17, not Sharp 1882*a*.

Selected References. Fall 1923: 89; Hatch 1953: 208; Larson 1975: 299.

Description. Length = 3.0 to 3.7 mm, width = 1.5 to 1.8 mm, length: width = 1.91 to 2.13. Body (Fig. 88A, B) elongate oval, widest slightly behind middle and broadly rounded posteriorly; somewhat depressed; lateral outline continuous in dorsal aspect with pronotum evenly arcuate laterally.

Color brown with elytra of most specimens distinctly maculate. Head dorsally dark brown to piceous (some specimens black) except transverse medial bar and anterior margin, red; head ventrally reddish or with genae infuscate on some specimens; antenna and palpi pale basally, infuscate apically. Pronotum with disc brown to piceous, seldom black, anterolateral angle and lateral margin broadly reddish. Elytron dark brown or piceous, most specimens with the following pale markings on disc; a transverse humeral band; and sublateral pale spots located antemedially, postmedially and subapically (extent of elytral maculation varies individually but even specimens with reduced maculation have humeral angle pale); epipleuron pale brown to dark reddish. Ventral surface largely black; prothorax laterally, prosternal process, metasternum and metacoxa along medial line, sterna 2 medially, and sterna 3 to 6 posteriorly and laterally dark reddish or piceous. Legs reddish to piceous.

Head with small, sparse, irregularly distributed punctures. Pronotum medially with punctures small and sparse, laterally punctures larger and denser but well separated. Elytron with punctures separated by about twice times their own diameter, each bearing a yellow seta about one and one half times longer than distance between punctures; epipleuron distinctly punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally moderately coarsely punctate; metacoxal plate with punctures separated by about one and one half to two times their own diameter, slightly shallower than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small, sparse and uniformly distributed. Microreticulation of body consisting of isodiametric meshes, similar on both sexes.

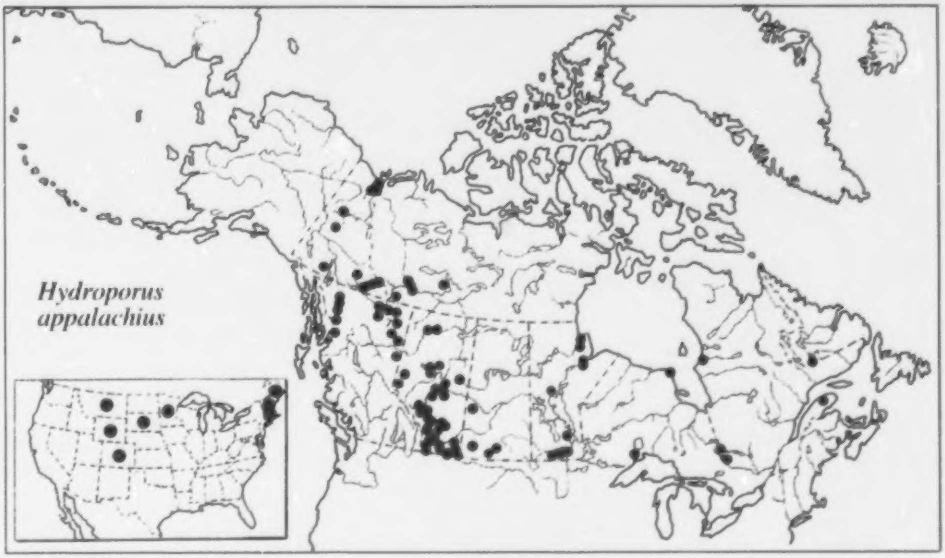
Pronotum with lateral bead complete but narrow; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle more or less right angled; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum with declivity well developed, prominence low and obtuse in lateral aspect and file well developed; process with blade narrow and elongate, bluntly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate or slightly protruding.

Male protibia width = 0.15 mm, protarsal ratio = 0.76 : 0.82 : 0.70 (Fig. 88D); protarsomere 1 with two pairs of adhesive scales, protarsomere 2 lacking scales; protarsal claws (Fig. 88C) inconspicuously modified, anterior claw very slightly broader than posterior. Aedeagus (Fig. 88E, F) in lateral aspect slender, evenly narrowed apically; in dorsal aspect more or less evenly narrowed to moderate point.

Comments. The problem of the species limits between *H. appalachius* and *H. occidentalis* are discussed below under *H. occidentalis*.

Ecology. This species is usually found in habitats where there is some water movement. For example in the Great Plains it is usually found in small streams and springs. Sherman (1913) found it along the margins of small lakes in the mountains of New Hampshire. Labrador specimens were collected from a protected shoreline of a large lake, a site where there is some wave action. The habitat in the northern parts of the range has not been described.

Distribution. Map 105. This species has a wide range in North America east of the Rocky Mountains. It occurs from Labrador and New Hampshire west to the northern Great Plains and north into the boreal zone and southern limits of the low arctic.



Map 105. *Hydroporus appalachius* Sherman. Canadian and Alaskan collection localities and United States state records.

32. *Hydroporus occidentalis* Sharp 1882
Fig. 89

Hydroporus occidentalis Sharp 1882*a*: 456. Type locality - "Lake Labache, British Columbia" [= Lac LaHache?]. Type in BMNH. Type not examined.

Selected References. Fall 1923: 90; Hatch 1953: 208; Leech and Chandler 1956: 317; Anderson 1962: 62; Larson 1975: 300.

Description. Length = 2.9 to 3.4 mm, width = 1.4 to 1.7 mm, length: width = 1.95 to 2.10. Habitus more robust than that of *H. appalachius*; body (Fig. 89A, B) widest behind middle and broadly rounded posteriorly; lateral outline continuous in dorsal aspect however the pronotum is broad with sides more abruptly rounded anteriorly and more or less parallel sided posteriorly.

Body mainly black. Head dorsally with anterior margin reddish to piceous, frontal bar between eyes reddish; head ventrally dark reddish to piceous, gula and genae concolorous; antenna with basal 3 or 4 antennomeres mainly pale, antennomeres 5 to 11 largely piceous; palpi pale with terminal palpomere of each palpus infuscate apically. Pronotum with anterolateral angle, and on some specimens, lateral margins, dark reddish or piceous. Elytron dark reddish to piceous, most specimens with humeral angle distinctly but diffusely paler; some specimens with shoulder and lateral margin concolorous with disc, other specimens with lateral margin pale basally and with lateral humeral, antemedial, postmedial and subapical pale spots; epipleuron dark reddish to piceous. Ventral surface of body mainly black. Legs dark reddish, femora basally and medially, tibiae apically and tarsi infuscate.

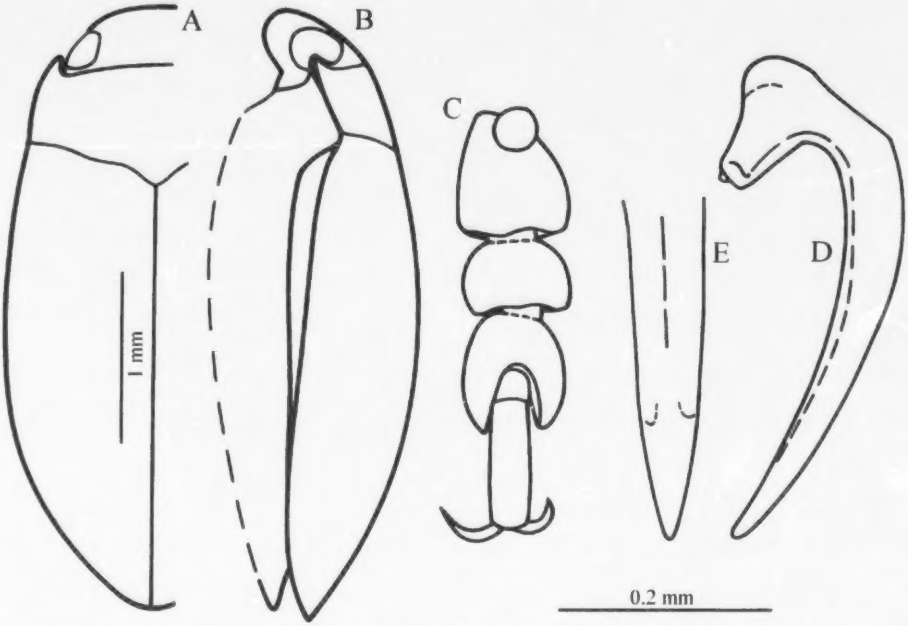


Fig. 89. *Hydroporus occidentalis* Sharp. A - left body outline, dorsal. B - body outline, lateral. C - male protarsus, dorsal. D - aedeagus, lateral. E - aedeagus apex, ventral.

Head with small irregularly distributed punctures. Pronotum medially with punctures small, sparse and of irregular size; punctures larger but not much denser towards margins. Elytron with punctures coarser than those on base of pronotum, separated by one and one half to two times their own diameter, each bearing an inconspicuous brownish seta subequal in length to distance between punctures; epipleuron distinctly punctate. Metasternum laterally with moderately coarse, irregularly spaced punctures; metacoxal plate with punctures smaller and more regularly spaced, separated by about one to one and one half times their own diameter, slightly smaller in size than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small and very sparse. Microreticulation of dorsal surface consisting of isodiametric meshes, similar on both sexes.

Antennomeres stout, antennomere 2 stout and oval with greatest width near middle, antennomere 5 more strongly dilated apically and more triangular in shape than corresponding antennomere in *H. appalachius*. Pronotum with lateral bead complete but very narrow; posterolateral angle slightly obtuse; basal margin sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight on anterolateral angle. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum with prominence low and obtuse in lateral aspect, file well developed; process with blade somewhat broad and elongate, pointed apically. Protibia with a single longitudinal row of punctures on anterior face. Metacoxal process conjointly with hind margin slightly produced and angulate medially.

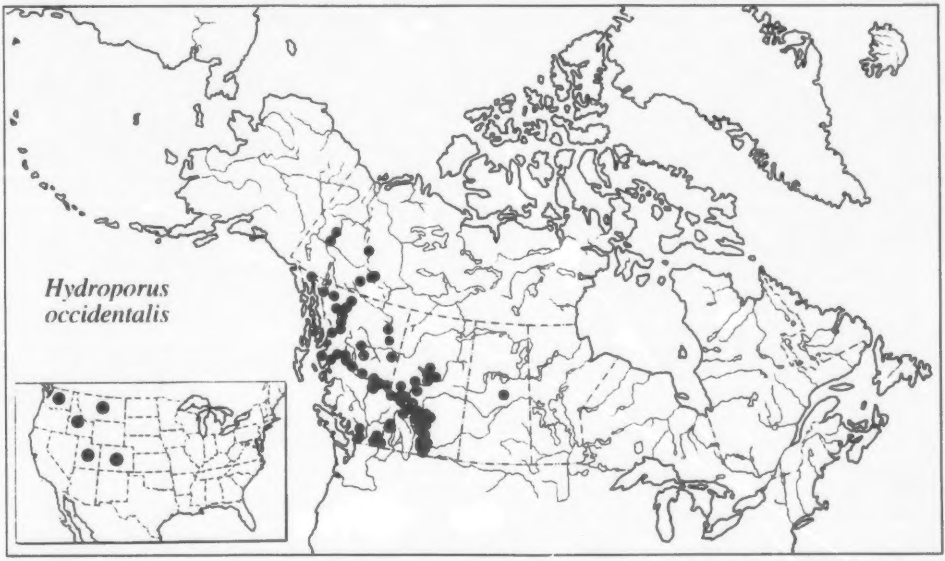
Male protibia width = 0.14 mm, protarsal ratio = 0.77 : 0.79 : 0.69 (Fig. 89C); protarsomere 1 with two pairs of adhesive scales, protarsomere 2 lacking scales; protarsal claws inconspicuously modified, anterior claw very slightly broader than posterior. Aedeagus (Fig. 89D, E) in lateral aspect slender, evenly narrowed apically; in dorsal aspect more or less evenly narrowed to moderate point.

Taxonomic Notes. As discussed by Larson (1975: 300), it is not clear if *H. occidentalis* is specifically distinct from *H. appalachius*. Although we have seen much more material from a wider geographical range, especially northern British Columbia and the Yukon Territory, we are no closer to resolving the problem. In general, specimens from the continent east of the Rocky and Mackenzie Mountains possess the characteristics of *H. appalachius*. Those from within the Cordilleran region are *H. occidentalis*. Most specimens of *H. occidentalis* lack elytral maculation or have it reduced to a humeral spot and a small subapical spot. However, some specimens have expanded maculations similar to those of typical *H. appalachius* specimens. The frequency and extent of maculation of *H. occidentalis* specimens is greatest among those from the Yukon Territory. Based on elytral pattern these specimens would be assigned to *H. appalachius* except they have the darker ground color and more robust body and thicker antenna of *H. occidentalis*.

All characters separating the two species are qualitative and aside from color, are rather subtle. Thus when color is inconsistent, assignment of specimens to species may be difficult. In spite of this, we favour recognition of two species because the two forms are largely allopatric and occupy somewhat different habitats, especially in the southern parts of their ranges. An alternative solution would be to recognize a polytypic species with two subspecies. We chose not to do this because it appears that populations interdigitate in the region of contact between the two forms and that most retain the characteristics of one or the other species so that there is no clear zone of hybridization.

Ecology. This species is common in small, silty bottomed alpine and subalpine pools and along the margins of lakes. Specimens also occur in small cold springs and seepage areas. Although found on both organic and inorganic substrates, the beetles are most abundant among plant debris.

Distribution. Map 106. The range extends along the western Cordillera from the southern Yukon Territory to Utah and California.



Map 106. ***Hydroporus occidentalis*** **Sharp. Canadian and Alaskan collection localities and United States state records.**

33. *Hydroporus spangleri* Gordon 1981

Fig. 90

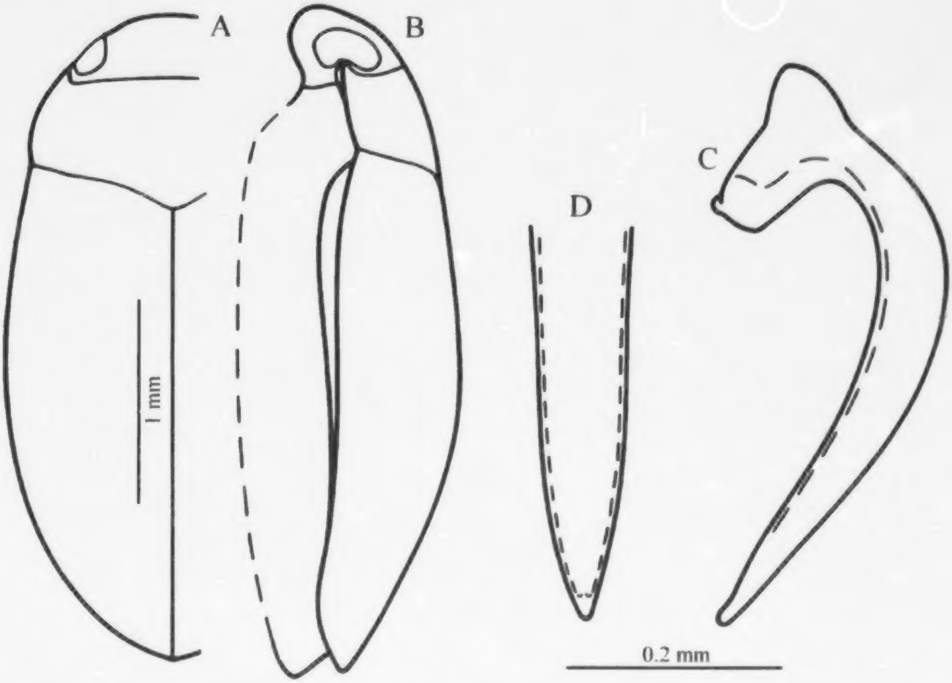


Fig. 90. *Hydroporus spangleri* Gordon. A - left body outline, dorsal. B - body outline, lateral. C - aedeagus, lateral. D - aedeagus apex, ventral.

Hydroporus spangleri Gordon 1981: 122. Holotype - male in USNM, labelled: Utah, Lambs Canyon nr. S. Lake City, vi.30.1949, G.K. Todd Colr./ P.J. Spangler, coll. 1958, 221697/ Robert Gordon, HOLOTYPE, *Hydroporus spangleri* (red label)/ HOLOTYPE, *Hydroporus spangleri* 6981 (red-rimmed label). Type examined.

Description. The holotype measures as follows: length = 3.3 mm, width = 1.8 mm, length: width = 1.91. Habitus (Fig. 90A, B) similar to *H. occidentalis*; body in dorsal aspect ovate, widest at middle of elytra and rounded posteriorly; lateral outline slightly discontinuous, pronotum broad with sides more abruptly rounded anteriorly and more or less parallel sided posteriorly to obtuse hind angles.

Color rufous to piceous. Head dorsally piceous, except frontal bar and anterior margin of clypeus, reddish; head ventrally reddish; antenna with antennomeres 1 and 2 testaceous, outer antennomeres infuscate apically or mainly piceous; palpi reddish with apical palpomere of each palpus infuscate. Pronotum piceous medially, lateral margin mesad of bead reddish. Elytron reddish; epipleuron red. Ventral surface mainly black, sternum 3 with a reddish spot on each side. Legs reddish.

Pronotum medially with punctures smaller and sparser; punctures coarser towards margins. Elytron with punctures coarse and subfoveate giving surface a dimpled appearance, diameter subequal to those on base of pronotum, punctures separated by about their own diameter, each bearing a pale seta subequal in length to distance between punctures; epipleuron distinctly punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate. Sternum 6 with punctures small and more or less evenly spaced. Microreticulation present over body.

Pronotum with lateral bead narrow; posterolateral angle obtuse; basal margin shallowly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum with file well developed with numerous fine transverse ridges, prominence low and obtuse in lateral aspect; blade narrow and elongate, narrowly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin broadly but distinctly angulate medially.

Male protibia width = 0.15 mm, protarsal ratio = 0.74: 0.71: 0.59; protarsal claws equal in length, unmodified, about half as long as apical protarsomere. Aedeagus (Fig. 90C, D) in dorsal aspect with sides nearly parallel, tapering to a point in apical third.

Comments. This species is similar to *H. occidentalis* which occurs in the same region. The two type specimens (the only known specimens) differ from most specimens of *H. occidentalis* in that the pronotum is more rounded, especially the hind angles which are more obtuse; setae paler; sternum 6 more evenly, densely and coarsely punctate; color paler, legs with femora less deeply infuscate, elytron with humerus and lateral margin not distinctly paler than disc, and pronotum more broadly reddish laterally. As these difference are generally subtle and lie within the range of variation of *H. occidentalis*, *H. spangleri* may prove to be a synonym of *H. occidentalis*.

Ecology. Not known.

Distribution. The species is known only from the type locality in Utah.

Hydroporus striola-group

Figs. 91 – 93

Small species, length 2.5 to 3.4 mm; body narrowly to moderately ovate, in dorsal aspect continuous or with a slight discontinuity in lateral outline between pronotum and elytron; color brown to black, elytra of most specimens with at least humeral angle, often entire base, pale; microreticulation present; pronotum with lateral bead narrow, lateral margin straight in lateral aspect; elytron in lateral aspect with lateral margin ascendant and epipleuron visible to or almost to humeral angle; protibia with a single longitudinal row of punctures; male protarsomere 1 with two or three pairs of scales on ventral surface, anterior protarsal claw broadened or with a ventral ridge.

The species occur in densely vegetated pools in the low arctic and boreal regions. One of the three North American species is Holarctic. Several additional Palaearctic species occur.

34. *Hydroporus aurora* Larson and Roughley, new species

Fig. 91

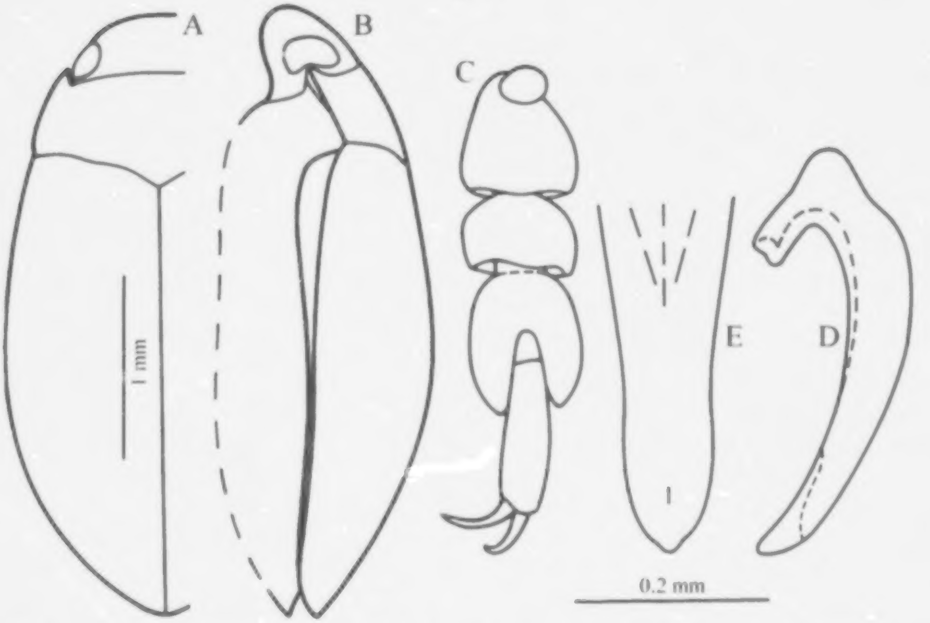


Fig. 91. *Hydroporus aurora* new species. A - left body outline, dorsal. B - body outline, lateral. C - male protarsus, dorsal. D - aedeagus, lateral. E - aedeagus apex, ventral.

HOLOTYPE - male from Canada, Northwest Territories labelled as follows: Reindeer Depot, Mackenzie Delta, VI-30-1948, W.J. Brown/ HOLOTYPE *Hydroporus aurora* Larson and Roughley (red label). Deposited in CNC.

ALLOTYPE - female, same data as holotype. Deposited in CNC.

PARATYPES - Following specimens designated paratypes: same data as holotype (42 CNC), same locality, VI-28-1948 (2 CNC), VII-14-1948 (1 CNC), VII-5-1948, Caribou Hills, (1 CNC), VIII-11-1948 (3 CNC). MANITOBA. Churchill, 18.vi.1937 (13 CNC), 21.vi.1937 (1 CNC), 23.vi.1937 (3 CNC), 29.vi.1937 (1 CNC), 1.vii.1937 (2 CNC), 6.vii.1937 (5 CNC), 7.vii.1937 (6 CNC), 9.vii.1937 (4 CNC), 10.viii.1937 (1 CNC), 15.viii.1937 (6 CNC), 18.viii.1937 (5 CNC), W.J. Brown. UNITED STATES. ALASKA. Killik R., 2 mi s Colville R., 2.viii.79, A.V. Morgan (2 A. Morgan Collection, Waterloo); Shaw Crk., M[ile] 289 Rich[ardson] Hwy, 23.v.1951, Mason and McGillis (1 CNC).

Derivation of name. The specific epithet is derived from the Latin, aurora, meaning light and it is used as a noun in apposition.

Description. Length = 3.1 to 3.4 mm, width = 2.1 to 2.5 mm, length: width = 1.89 to 1.98. Body (Fig. 91A, B) relatively broad with point of maximum width well posterior of middle and broadly rounded posteriorly; pronotum broad, many specimens with lateral margin more arcuate than that of elytron and therefore lateral outline of body slightly discontinuous in dorsal aspect.

Color pale brown to dark brown or rufopiceous. Head dorsally yellow to reddish brown except frons mesad to each eye and along hind margin, darker brown to piceous; head ventrally yellow; antenna pale with outer antennomeres infuscate apically; palpi pale, apical palpomere lightly infuscate, at least on maxillary palpus. Pronotum with disc dark reddish brown to piceous, most specimens with basal half of disc slightly paler than anterior half, anterolateral angle and lateral margin paler, yellow to reddish. Elytron yellow with sutural margin and medial and apical areas of disc brown to piceous; epipleuron yellowish. Ventral surface mainly piceous to black with prothorax laterally, prosternal process, metacoxal process, and sterna 3 to 5 laterally, and 6 marginally, reddish. Legs pale reddish brown.

Head with punctures small but of varied size and relatively sparse. Pronotum medially with punctures very small and sparse (almost impunctate in some male specimens; punctures much coarser laterally and posteriorly, many specimens with anterior submarginal punctures closely set and forming an almost continuous transverse groove; punctures almost confluent on posterolateral angle. Elytron with punctures about as coarse as those on base of pronotum, separated by one and one half to two times their own diameter, each bearing a yellow seta slightly longer than distance between punctures; epipleuron shallowly and sparsely punctate. Ventral surface with punctation various, punctures deepest on metasternal wing, shallower and more evenly spaced on metacoxal plate; sternum 6 with punctures very small and sparse. Microreticulation of body present but that of pronotum and elytral disc lightly impressed, especially on male which is rather shiny.

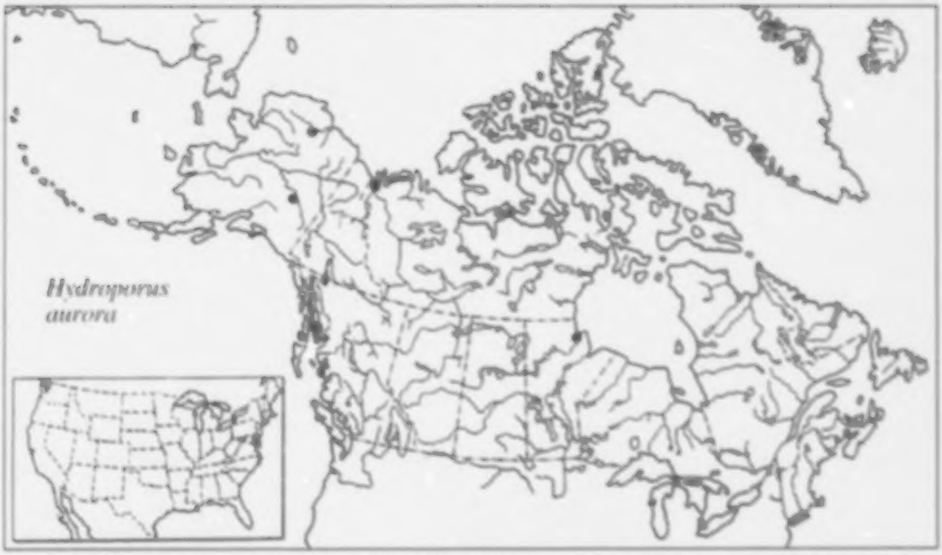
Pronotum with disc distinctly convex, more so than in *H. striola*, lateral bead narrow; posterolateral angle slightly produced and acute and slightly to distinctly deflected downwards; basal margin shallowly sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron with lateral margin relatively strongly ascendant in lateral aspect, epipleuron visible almost to shoulder. Prosternum with prominence broadly obtuse, file with obsolete transverse rugae; process with blade narrow and elongate, bluntly pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal processes conjointly with hind margin very faintly and broadly produced medially.

Male protibia width = 0.14 mm, protarsal ratio = 0.76 : 0.81 : 0.76 (Fig. 91C); protarsomeres 1 and 2 with two and one pairs of ventral scales respectively; anterior protarsal claw slightly shorter than posterior, broader and more strongly arcuate. Aedeagus (Fig. 91D, E) short and broad.

Comments. This species appears to be close to *H. striola* and has generally been confused with it in collections. The sparse, fine punctation of the pronotum and the subtly bicolored pronotal disk will permit the recognition of most specimens. The western arctic distribution makes it possible the species occurs in the eastern Palaearctic but we have not been able to relate it to the very limited material we have examined from that region.

Ecology. This species has been collected from among dense emergent vegetation along the margin of small tundra ponds.

Distribution. Map 107. This species is known from only a few arctic localities west of Hudson Bay.



Map 107. *Hydroporus aurora* Larson and Roughley. Canadian and Alaskan collection localities and United States state records.

35. *Hydroporus boraeorum* Larson and Roughley, new species
Fig. 92

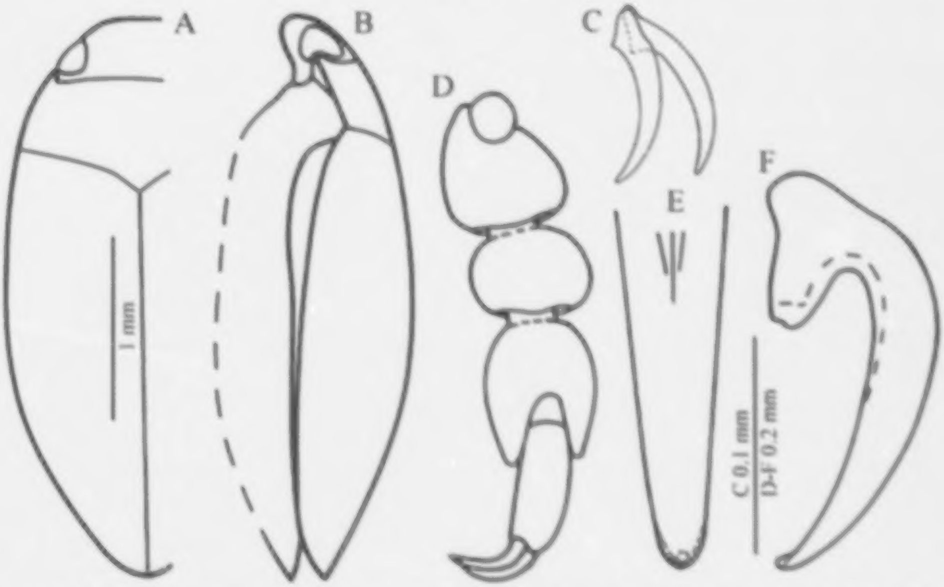


Fig. 92. *Hydroporus boraeorum* new species. A - left body outline, dorsal. B - body outline, lateral. C - male protarsal claws, anterior. D - male protarsus, dorsal. E - aedeagus, lateral. F - aedeagus apex, ventral.

HOLOTYPE - male from Canada, Northwest Territories, labelled as follows: Reindeer Depot, Mackenzie Delta, VI-30-1948, W.J. Brown/ HOLOTYPE Hyd*roporus boraeorum* Larson and Roughley. Deposited in CNC.

ALLOTYPE - female, same data as holotype. Deposited in CNC.

PARATYPES - designated as follows: same data as holotype (45 CNC), VI-26-1948 (2 CNC), VI- 28-1948 (13 CNC), 12.vii.1948 (1 CNC), 3.viii.1948 (8 CNC), 7.viii.1948 (1, CNC), 11.viii.1948 (5 CNC). BRITISH COLUMBIA. Hwy 37, km 723 nr Blue River, 18.vii.87, Larson & Carr (20 MUN). MANITOBA. Churchill, 18.viii.1937, W.J. Brown (2 CNC); Mile 473 H[udson B[ay] R[ailway], 3.viii.1952, J.G. Chilcott (1 CNC). NORTHWEST TERRITORIES. Hwy. 4 crossing Cameron R., 19.vii.1981, Lot 2, BF and JL Carr (1 MUN, 20 CARR); Mile 306 Dempster Hwy., 4.vii.1979, Lot 1, BF and JL Carr (29 CARR), 9.viii.1979 (2 MUN, 2 CARR); Powder Point, Hwy. 4, 17.vii.81, lot 4, BF and JL Carr (10 CARR), Prosperous Lake, Hwy. 4, 11.vii.81, Lot 2, BF and JL Carr (12 CARR); . YUKON TERRITORY. Firth R., 31.vii.1956, E.F. Cashman (1 CNC); Klokut arch[eological] site, 6 mi. N Old Crow, 6754'N 13941'W, 16.vii.1977, R.E. Roughley coll. (13 JBWM), 19.vii.1977 ex shallow margin of small lake (4 JBWM), 3.viii.1977 ex pitfall traps in poplar zone of Porcupine R. (1 JBWM); Mayo (airport lake) 6337'24"N 13550'18"W, 30.vi.1977R.E. Roughley coll. (10 JBWM), 4.vii.1977 (2 JBWM); Minto, 26.vi.79, Lot 1, BF and JL Carr (1 CARR); Von Wilczek L., 45 km s Minto, 30.vii.87, Larson & Carr (15 MUN); Hwy 4, 35 km e Carmacks, 30.vii.87, Larson & Carr (9 MUN); Hwy 4, e end Little Salmon Lake, 29.vii.87, Larson & Carr (92 MUN); Proctor's Saw Mill on Stewart River, 6333'30"N 13725' W, coll. treading grass tussocks 2'-8' from shore of pond, R.E. Roughley coll. (4 JBWM).

Derivation of name. The specific name is derived from the genitive plural of the Latin, *boreus*, meaning of the gods of the north.

Description. Length = 2.5 to 2.9 mm, width = 1.3 to 1.5 mm, length: width = 1.88 to 2.00. Body (Fig. 92A, B) oval with point of maximum width near or slightly behind middle, rather angularly attenuate posteriorly. Pronotum with posterolateral angle at most very narrowly rounded, lateral margin not or slightly more arcuate than that of elytron and therefore lateral outline of body more or less continuous to slightly discontinuous in dorsal aspect.

Color pale brown to dark brown with pronotum piceous to black. Head dorsally reddish yellow except a spot mesad to each eye and hind margin, brown; head ventrally yellowish; antenna yellow basally, antennomeres 3 to 11 variously infuscate; palpi yellow, apical palpomere of at least maxillary palpus infuscate. Pronotum piceous to black with lateral margins broadly reddish. Elytron bicolored, lateral margin and basal one fifth to one quarter, and on many specimens also a subapical spot, yellowish; sutural margin and rest of disc brown with a darker piceous area centred on suture near middle; epipleuron yellowish. Ventral surface mainly piceous to black. Legs yellowish.

Head with small, deep, relatively sparse punctures. Pronotum medially with punctures of moderate size, sparse; punctures larger and denser towards margins, not longitudinally confluent on posterolateral angle. Elytron with punctures separated by one and one half to two times their own diameter, each bearing a pale seta distinctly longer than distance between punctures; epipleuron finely and sparsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures subequal in size. Sternum 6 with punctures small but deep and conspicuous and evenly distributed. Dorsal surface distinctly microreticulate, some specimens with lines shallow or obsolete behind punctures; female with lines deeper than male, some meshes faintly granulate.

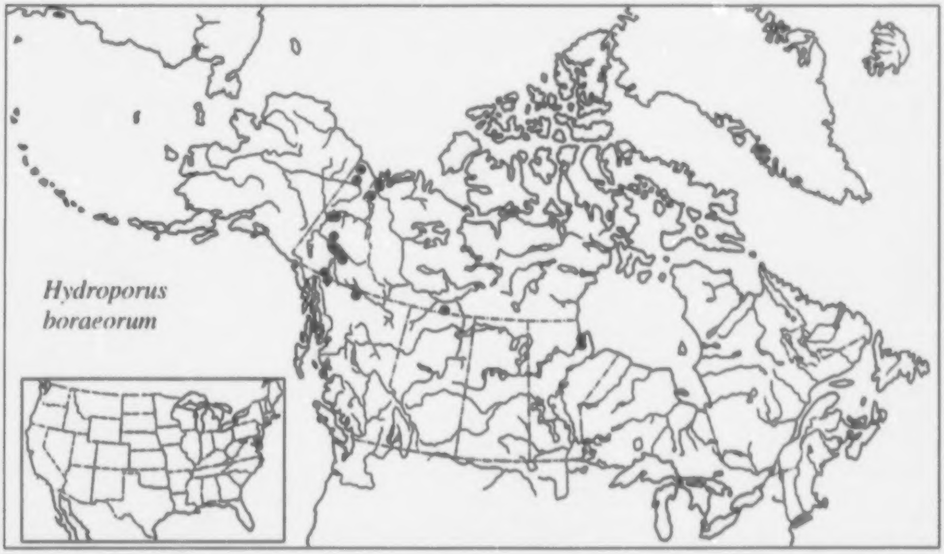
Pronotum with lateral bead narrow; posterolateral angle more or less right angled to slightly obtuse; basal margin almost straight on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron with lateral margin ascendant in lateral aspect, epipleuron visible to or disappearing shortly posterior to shoulder. Prosternum with prominence and file obsolete; blade narrow and elongate, bluntly pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin slightly and narrowly produced medially. Abdomen rather strongly tapered apically, sternum 6 triangular and narrowly rounded apically.

Male protibia width = 0.13 mm, protarsal ratio = 0.88 : 0.90 : 0.83 (Fig. 92D); protarsal claws (Fig. 92C) subequal in length, anterior claw slightly broader than posterior claw. Aedeagus (Fig. 92E, F) similar to that of *H. striola* but with apical knob slightly shorter and a little more arcuate.

Comments. This species is similar to the Palaearctic *H. palustris* but is well characterized on the basis of its smaller size and slenderer shape. Within the Nearctic region, specimens of this species are easily recognized, even in the field, by their small size and brightly bicolored elytra.

Ecology. Specimens have been collected at the margins of small, boggy lakes where the beetles occur at the heads of small moss and sedge chocked embayments or disused beaver runs, back from the margin of the open water and in sites where the water temperature remains cold.

Distribution. Map 108. Collection localities lie in the low arctic and northern boreal zones west of Hudson Bay.



Map 108. *Hydroporus boraeorum* Larson and Roughley. Canadian and Alaskan collection localities and United States state records.

36. *Hydroporus striola* Gyllenhal 1827

Fig. 93

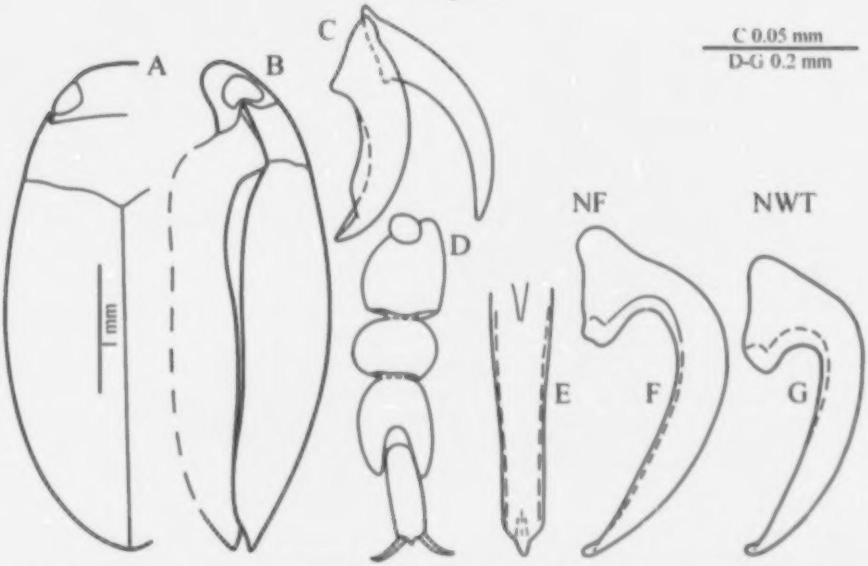


Fig. 93. *Hydroporus striola* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsal claws, anterior. D - protarsus. E - aedeagus apex, Ventral. F,G - aedeagus, lateral. NF - Newfoundland; NWT - Northwest Territory.

Hydroporus striola Gyllenhal 1827: 393. Type locality given as "in aquis Lapponiae". Type should be in the Zoological Museum, Uppsala, Sweden. Type not examined.

Hydroporus subtonsus LeConte 1855: 297. LECTOTYPE - here designated, male in MCZC labelled: intact pale blue disc [indicating Lake Superior]/ Type 6028/ *H. subtonsus* Lec./ J.L. LeConte Collection/ LECTOTYPE *Hydroporus subtonsus* LeConte des. Larson and Roughley.

Selected References. Sharp 1882*a*: 473; Zimmermann 1919: 165; Fall 1923: 94; Hatch 1953: 210; Zaitzev 1953: 158; Gordon and Post 1965: 18; Larson 1975: 306; Hilsenhoff 1995: 14; Nilsson and Holmen 1995: 65.

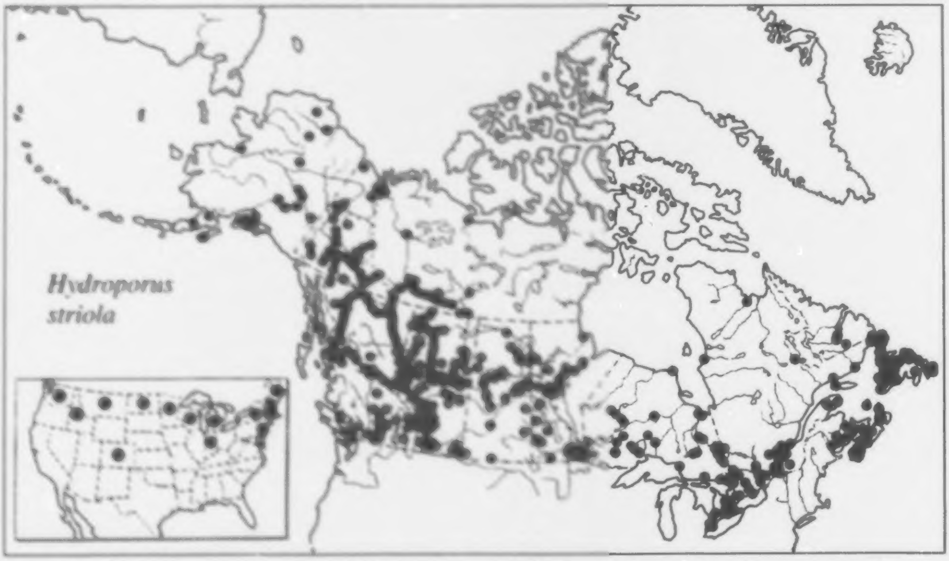
Description. Length = 2.9 to 3.4 mm, width = 1.4 to 1.8 mm, length: width = 1.91 to 2.12. Body (Fig. 93A, B) elongate-oval, widest at or slightly behind middle and rounded posteriorly. Pronotum with posterolateral angle narrowly rounded, lateral margin slightly more arcuate than that of elytron and therefore lateral outline of body slightly discontinuous in dorsal aspect.

Color reddish-brown with pronotum darker. Head dorsally dark brown to piceous, rarely black, with a transverse bar between eyes, clypeus and anterior margin or a triangular anteromedial portion of frons, reddish; head ventrally reddish or genae darker. Antenna with antennomeres 1 and 2 yellow, distal antennomeres piceous, at least apically; palpi testaceous with apical palpomere of each palpus infuscate apically. Pronotum with disc dark brown to piceous medially, rarely black; anterolateral angle and lateral margin broadly reddish but darkened towards base. Elytron varied in color, from brown to dark reddish or piceous; most specimens with lateral margin and base paler, many specimens with a poorly defined basomedial pale area; epipleuron reddish basally, darker apically. Ventral surface mainly black except prosternal process, metacoxal processes, and sterna 3 to 6 posteriorly, reddish to piceous. Legs reddish, femora basally, tibia externally and tarsi, infuscate.

Head with distinct, irregularly spaced punctures. Pronotum distinctly punctate; punctures larger and denser towards margins; punctures crowded but not longitudinally confluent on posterolateral angle. Elytron with punctures moderately coarse, separated by one and one half to two times their own diameter, each bearing a yellowish seta longer than distance between punctures; epipleuron finely to rather coarsely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally with punctures relatively small, those on metacoxal plate separated by about two times their own diameter, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small, largest and densest along hind margin. Microreticulation of dorsal surface complete and well impressed.

Pronotum with lateral bead narrow; posterolateral angle narrowly rounded, more or less right angled; basal margin sinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron with lateral margin strongly ascendant in lateral aspect, epipleuron visible to or disappearing only shortly posterior to shoulder. Prosternum raised laterally and anteriorly with medial depression at base of process shallow but distinct; prominence well developed but obtuse in lateral aspect and file well developed; process with blade narrow and elongate, rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate or only very slightly produced medially.

Male protibia width = 0.15 mm, protarsal ratio = 0.80: 0.80: 0.73 (Fig. 93D); tarsomeres 1 and 2 with three and two pairs of adhesive scales on ventral surface, respectively; anterior protarsal claw (Fig. 93C) subequal in length to posterior claw, but



Map 109. *Hydroporus striola* (Gyllenhal). Canadian and Alaskan collection localities and United States state records.

with a ventral flange along anterior margin which makes it broader with a subapical ventral tooth or projection. Aedeagus (Fig. 93E – G) relatively short, in lateral aspect with apex slightly reflexed; in ventral aspect abruptly narrowed at apex to small knob-like protuberance.

Ecology. This is the most ubiquitous species of *Hydroporus* in the boreal zone of the North Temperate region. It is also abundant in the Cordilleran region. The species is absent from short grass prairie but occurs in fescue grasslands and in the parkland belt. The species occurs in almost all types of small, standing water where emergent vegetation is dense. Specimens occur in peatland pools, being most common in fen habitat and rather infrequent in ombrotrophic bog pools. Nilsson (1986*b)* described the mature larva based on European material and Alarie (1991) described all larval instars based on Nearctic specimens.

Distribution. Map 109. The species occurs across northern Eurasia and northern North America, from the low arctic south to New Jersey, Illinois and Colorado.

Hydroporus transpunctatus-group
Figs. 94; 95

Length medium to large, 3.9 to 5.2 mm; body elongate oval, lateral outline continuous to slightly discontinuous; color relatively dark, ventral surface of head including gula, piceous to black; punctation relatively fine, especially on pronotal disc and metacoxal plate, reticulation lightly impressed or partly obsolete; pronotum with lateral margin straight in lateral aspect; elytron with lateral margin ascendant to shoulder; protibia with a single longitudinal row of punctures on anterior face; male protarsomeres short and rounded, especially tarsomere 3, protarsomere 1 apparently with three or more pairs of adhesive scales beneath; aedeagus elongate, strongly sclerotized and sinuate in lateral aspect.

The three species of this group occur in the mountains and foothills of western North America. The species are generally inhabitants of small springs and seepages.

37. *Hydroporus transpunctatus* Chandler 1941
Fig. 94A – D

Hydroporus funestus Fall 1923: 80, not Schilsky 1888: 183. Holotype - male in MCZC labelled: Tuolumne Meadows, Cal. 8/16/16 /Above Eliz[abeth] Lake, 11000 ft/ TYPE *funestus*/ M.C.Z. Type 23934 (red label)/ H.C. FALL COLLECTION/ HOLOTYPE, *Hydroporus funestus* Fall, 1923 (red label). Type examined. NEW SYNONYMY.

Hydroporus transpunctatus Chandler 1941: 103. Holotype - male in Brigham Young University, Provo, Utah, from Salamander Lake, Mt. Timpanogas, Utah Co., Utah. Type not examined.

Selected References. Anderson 1962: 63; Larson 1975: 308.

Description. Length = 4.5 to 5.2 mm, width = 2.2 to 2.6 mm, length: width = 1.97 to 2.00. Body elongate-oval in dorsal aspect, point of maximum width near or slightly behind middle and body rounded posteriorly. Pronotum with lateral margins relatively strongly arcuate; lateral margins of pronotum and elytra slightly to distinctly discontinuous in dorsal aspect.

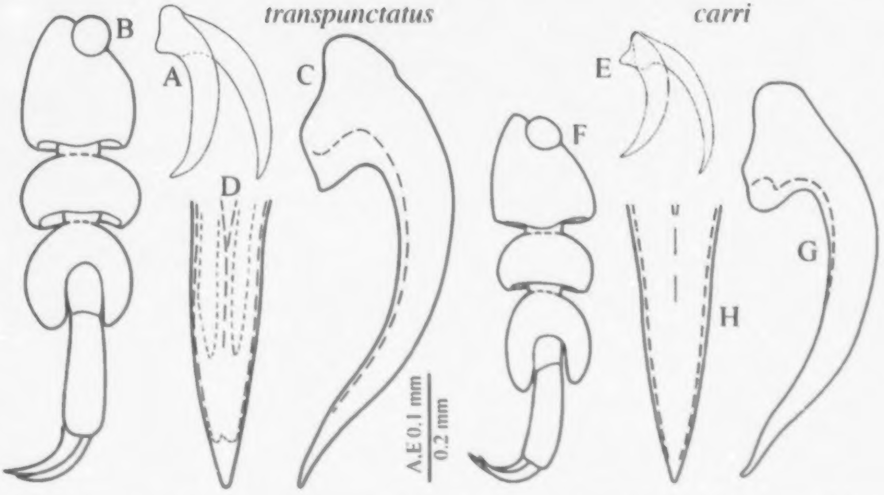


Fig. 94. *Hydroporus male*. *A – D - H. transpunctatus*. A - protarsal claws, anterior. B - protarsus. C - aedeagus, lateral. D - aedeagus apex, ventral. E – H - *H. carri*. E - protarsal claws, anterior. F - protarsus. G - aedeagus, lateral. H - aedeagus apex, ventral.

Color mainly black, some specimens with elytra dark brown. Head dorsally black except frontal bar and a small triangular area above base of each antenna, reddish; head ventrally black; antenna dark, infuscation beginning on antennomere 1 or 2; palpi with all palpomeres infuscate. Pronotum black with lateral margin dark piceous. Elytron dark brown or piceous medially, basal and lateral margins brown to reddish; epipleuron piceous to black. Ventral surface mainly black, sterna 3 to 5 with a reddish lateral spot. Legs with coxa, trochanter and femur mainly piceous, tibia and tarsi reddish to rufopiceous.

Head with small, deep, moderately dense punctures. Pronotum punctate over entire disc but medially punctures sparser and of irregular size consisting of intermixed setiferous and smaller nonsetiferous punctures; punctures larger and denser near margins. Elytron with punctures fine to moderately coarse, on most specimens tending to form irregular transverse rows, punctures separated by 1 to 2 times their own diameter, each bearing a yellowish seta, seta one and one half to two times as long as distance between punctures; epipleuron finely and sparsely punctate. Metasternum laterally moderately coarsely punctate, metacoxal plate with punctures conspicuously smaller and shallower and more widely and evenly distributed. Sternum 6 with punctures moderate, punctures somewhat denser posteromedially. Microreticulation present dorsally, many specimens with lines lightly impressed on pronotum and elytron and body somewhat shiny; males and many females with lines of sculpture on elytron obsolete immediately posterior to each puncture (at least on basal part of disc) producing a shiny area behind and partly surrounding puncture; some females without such shiny areas but with meshes distinctly transverse (many such females without punctures in evident transverse series).

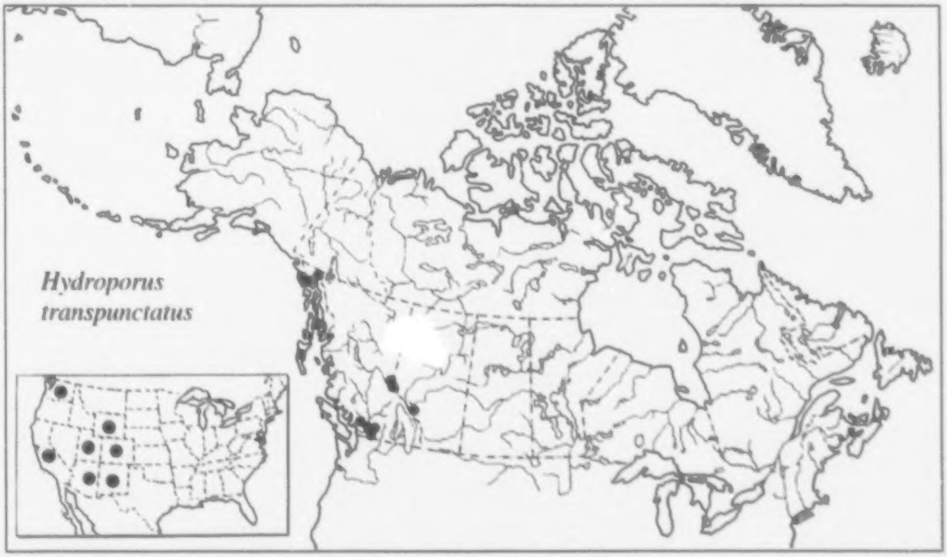
Antenna relatively stout. Pronotum with lateral bead clearly delimited and of moderate width, on some specimens slightly widening anteriorly; posterolateral angle obtuse; basal margin bisinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternal file well developed, prominence distinct, low and obtuse to acute in lateral aspect; blade narrow and pointed apically, strongly tectiform and longitudinally glabrous medially. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate or very slightly and broadly angulate medially.

Male protibia width = 0.20 to 0.26 mm, protarsal ratio = 0.80: 0.81: 0.70 (Fig. 94B); protarsomeres 1 to 3 short and rounded, protarsomere 3 almost circular; protarsomere 1 bearing numerous small oval scales on ventral surface; anterior protarsal claw (Fig. 94 A) slightly shorter and stouter than posterior, both shorter than those of *H. carri* and not so strongly arcuate medially. Aedeagus (Fig. 94C, D) apically sinuate in lateral aspect.

Comments. This species shows a great deal of geographic variation. Specimens from the southern portion of the range (Utah, Colorado, New Mexico and Arizona) are large, the antennomeres are relatively elongate, and the elytral punctures are small and arranged in obvious transverse rows. Specimens from western British Columbia and Alaska are smaller, the outer antennomeres are shorter and more robust, and the elytral punctures are much coarser and are at best faintly transverse in arrangement. Specimens from Alberta and Wyoming are intermediate. Pacific coast specimens belong to the taxon described as *H. funestus* by Fall (1923). However, this name is preoccupied by *H. funestus* Schilsky 1888, making *H. transpunctatus* Chandler the next available name.

Ecology. Specimens usually occur in water that is at least weakly flowing, such as seeps, small springs and spring-fed pools in alpine and subalpine areas. The beetles are usually on organic substrates and occur among emergent sedges and rushes or in thin algae-moss layers.

Distribution. Map 110. Although the species has not been well collected, collection records suggest a wide distribution throughout much of mountainous western North America. Specimens have been seen from western Alberta to southern Alaska, and south to New Mexico, Arizona and California.



Map 110. *Hydroporus transpunctatus* Chandler. Canadian and Alaskan collection localities and United States state records.

38. *Hydroporus carri* Larson 1975

Fig. 94E – H

Hydroporus carri Larson 1975: 307. Holotype - male in CNC labelled: Alta., Tp. 13 Rge. 29 W 4 Mer., 15.viii.1972, D and M. Larson / Holotype Hydroporus carri Larson/ Holotype Hydroporus carri Larson CNC No. 16630. The type locality is a spring on the headwaters of Trout Creek, Porcupine Hills, Alberta, Canada. Type examined.

Description. Length = 3.9 to 4.3 mm, width = 2.0 to 2.3 mm, length: width = 1.89 to 1.96. Body ovate, widest at middle and somewhat attenuate posteriorly; lateral outline continuous in dorsal aspect.

Color mainly black with elytron brown to piceous. Head dorsally black except frontal bar and a small spot above each antenna, reddish; head ventrally black, gula not paler. Antenna with basal 2 or 3 antennomeres yellow, outer antennomeres largely infuscate; palpi pale, infuscate apically. Pronotum black except lateral bead and margin narrowly mesad to bead, reddish. Elytron dark brown or piceous medially, paler brown laterally and basally; epipleuron piceous along inner margin, shoulder and outer margin paler. Ventral surface mainly black, sterna 3 to 5 each with a rufous lateral spot, sternum 6 narrowly rufous apically. Legs reddish except coxa, basal two thirds of femora, tibia apically and tarsi infuscate.

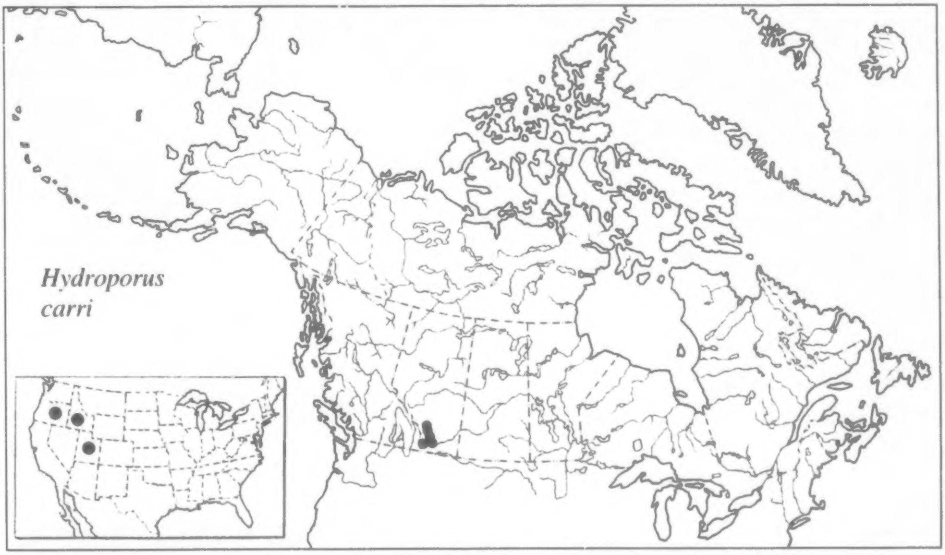
Head with small relatively widely spaced punctures, largest and densest medially and in shallow frontal depressions. Pronotum with punctures very small and sparse on medial portions of disc, most without setae; punctures near margins somewhat larger and bearing setae. Elytron with punctures relatively small, subequal to or coarser than those on base of pronotum, punctures separated by about two times their own diameter, each bearing a pale seta about as long as distance between punctures; epipleuron moderately coarsely and sparsely punctate. Metasternum laterally and sterna 1 and 2 laterally with coarse but separated punctures; metacoxal plate with punctures small and separated by about two to three times their own diameter; sternum 6 with punctures sparse anteriorly, crowded posteromedially but generally separated. Microreticulation of dorsal surface of body shallowly impressed and pronotum and elytra shiny, especially on male; metasternum medially with microsculpture obsolete, remainder of ventral surface with at least shallowly impressed lines.

Pronotum with lateral margins rather strongly rounded towards anterior angles, less so posteriorly; lateral bead well delimited, relatively broad and slightly widening anteriorly; posterolateral angle obtuse; basal margin bisinuate on each side of posteromedial lobe; lateral margin in lateral aspect straight. Elytron with lateral margin distinctly ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternal process with file well developed, prominence evident and obtuse to slightly acute in lateral aspect; blade narrow and elongate, bluntly pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin narrowly and distinctly angulate medially.

Male protibia width = 0.19 mm, protarsal ratio = 0.86: 0.81: 0.67 (Fig. 94F); tarsomere 2 transverse, tarsomere 3 almost circular in outline; tarsomere 1 with three and tarsomere 2 with one pair of relatively large oval scales beneath; protarsal claws (Fig. 94E) subequal in length and similar in shape, elongate, slightly more arcuate in lateral aspect than mesotarsal claws. Aedeagus (Fig. 94G, H) in lateral aspect with apex sinuate, in dorsal aspect narrowed with sides slightly sinuate towards apex.

Ecology. These beetles occur in small springs and seepage areas in foothill and subalpine areas (Larson 1975). These habitats are in prime ranching country and are very susceptible to damage from livestock, especially due to pocketing of the soft ground with hoof imprints and disruption of water flow patterns. Thus this species is endangered throughout much of its range (Roughley and Larson 1991). However, the species is capable of colonizing suitable habitat. For example, a very small spring-fed brook flowing over an artificially flattened area adjacent to a road 10 km s. Hillcrest, Alberta, contained specimens (J. Carr, *in lit.*). Teneral specimens were seen from Idaho (27 km S Prairie, 31.v.1986 (CARR)).

Distribution. Map 111. This species has been collected from southern Alberta, Idaho, Utah and Oregon (Lehman Springs, Hwy. 244 (CARR)).



Map 111. *Hydroporus carri* Larson. Canadian and Alaskan collection localities and United States state records.

39. *Hydroporus klamathensis* Larson and Roughley, new species

Fig. 95

HOLOTYPE - male labelled: Oregon, Klamath Co., Bly Mtn., 4900', 24.6.74, A. and D. Smetana. Deposited in CNC.

ALLOTYPE - female same collection data as holotype. Deposited in CNC.

PARATYPES - OREGON- 1 male, same collection data as holotype; CNC. CALIFORNIA - Sonoma Co., Hwy 1 6 mi. N Jenner, 26.VI.91, lot 1, B.F. and J.L. Carr, 1 male (CARR).

Derivation of name. The specific name is derived from Klamath Co., Oregon, the region in which the type specimen was collected.

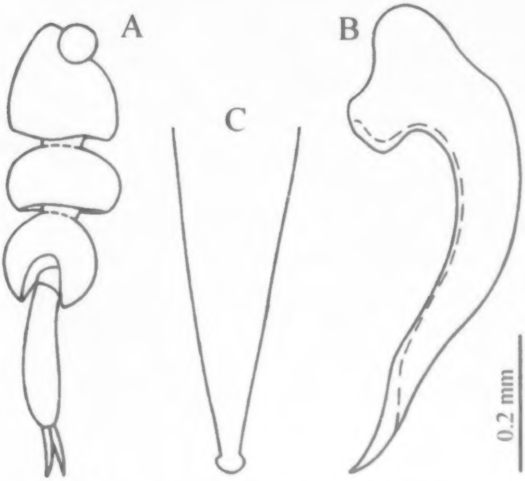


Fig. 95. *Hydroporus klamathensis* new species. A - male protarsus, dorsal. B - aedeagus, lateral. C - aedeagus apex, ventral.

Description. Length = 4.0 to 4.4 mm, width = 2.1 to 2.2 mm, length: width = 1.91 to 1.98. Body elongate oval with point of maximum width near middle and evenly narrowed posteriorly; lateral outline continuous in dorsal aspect.

Color mainly black. Head dorsally black except transverse bar between hind margins of eyes and front above base of antenna, reddish; ventral surface including gula piceous to black; antenna yellow basally, antennomeres 4 or 5 to 11 darkened; palpi yellow with terminal palpomere of each palpus infuscate. Pronotum with disc black, lateral bead and anterior margin translucent, reddish. Elytron brown to piceous; epipleuron brown to piceous. Ventral surface predominantly black but sterna 2 to 5 each with a lateral reddish spot, sternum 6 with lateral margins reddish. Legs reddish with femora basally and tarsi infuscate.

Head with moderately dense, small punctures. Pronotum medially with punctures sparse, small and inconspicuous and lacking setae; near margins punctures deeper and denser but still relatively sparse, bearing conspicuous setae. Elytron with punctures fine, subequal to or slightly coarser than those on base of pronotum, punctures separated by about one and one half to two times their own diameters, each bearing a seta slightly longer than distance between punctures; epipleuron finely but distinctly punctate. Metasternum laterally coarsely punctate; metacoxal plate with punctures conspicuously smaller, separated by about two to three times their own diameter and evenly distributed over plate; abdominal sterna 1 and 2 laterally with punctures less coarse than those of metasternal wing but coarser than those of metacoxal plate. Sternum 6 with punctures small basally and laterally, larger and distinctly crowded posteromedially. Entire body with evident microreticulation, lines shallow on disc of pronotum and elytra of males and surfaces relatively shiny, sculpture deeper on female.

Pronotum with lateral bead well delimited, of moderate width and gradually widened anteriorly; posterolateral angle more or less right angled; basal margin bisinuate on each side of posteromedial lobe; lateral margin in lateral aspect more or less straight. Elytron with lateral margin slightly ascendant in lateral aspect, epipleuron disappearing well posterior to shoulder. Prosternal process with prominence evident but obtuse in lateral aspect, file well developed; blade narrow, acute apically. Protibia with a single longitudinal row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate to slightly produced medially.

Male protibia width = 0.18 to 0.19 mm, protarsal ratio = 0.78: 0.78: 0.65 (Fig. 95A); protarsomere 3 almost circular in outline; tarsomeres 1 and 2 with undetermined number of large oval scales on ventral surface (specimens damaged and very dirty); protarsal claws slender, anterior slightly shorter and broader than posterior, both evenly and relatively strongly arcuate. Aedeagus (Fig. 95B, C) sinuate in lateral aspect, apex spatulate. Female with protarsi narrower than those of male but protarsomere 3 more or less circular in outline.

Comments. This species is similar to *H. carri* and *H. transpunctatus*. Specimens differ from those of *H. carri* by being more finely and sparsely punctate, protarsomere 3 is more circular, protarsal claws of male are slightly slenderer and more arcuate basally, and the apex of the aedeagus is broadened and spatulate in dorsal aspect.

A specimen of *H. klamathensis* in CASC is labelled, with a red label, as allotype of *H. leechi* Gordon. This specimen is not conspecific with the holotype of *H. leechi* Gordon and the allotype designation was not made in the original description of the species so that the label is not valid.

Ecology. Not known. Like related species, it is probably an inhabitant of springs. The type specimens, collected June 24, are teneral.

Distribution. Specimens are known from southwestern Oregon and northern California. In addition to the type specimens, a male specimen labelled allotype *H. leechi* Gordon (see above under *H. leechi*) was examined (CALIFORNIA, nw Corner Glenn Co., 6500', 4.5 mi s Mendocino Pass, CASC).

Hydroporus longiusculus-group

Fig. 96

Length = 3.4 to 4.3 mm; body relatively elongate and parallel-sided; color piceous to black, elytra of many specimens with at least humeral angle pale, some specimens with expanded pale markings; dorsal punctation relatively coarse, surface microreticulate; pronotum in lateral aspect with lateral margin straight; elytron in lateral aspect with lateral margin ascendant; protibia with longitudinal row of punctures of anterior face doubled or irregular basally; metacoxal processes with hind margin broadly but distinctly angulate.

The group contains one polymorphic species which has a wide distribution west of the Rocky Mountains.

40. *Hydroporus longiusculus* Gemminger and Harold 1868

Fig. 96.

Hydroporus oblongus Aubé 1838*b*: 605. Type locality - Unalaska, Alaska. Type supposedly in Institute Royale d'Historie Naturelle, Brussels, not examined. [not Stephens 1835].

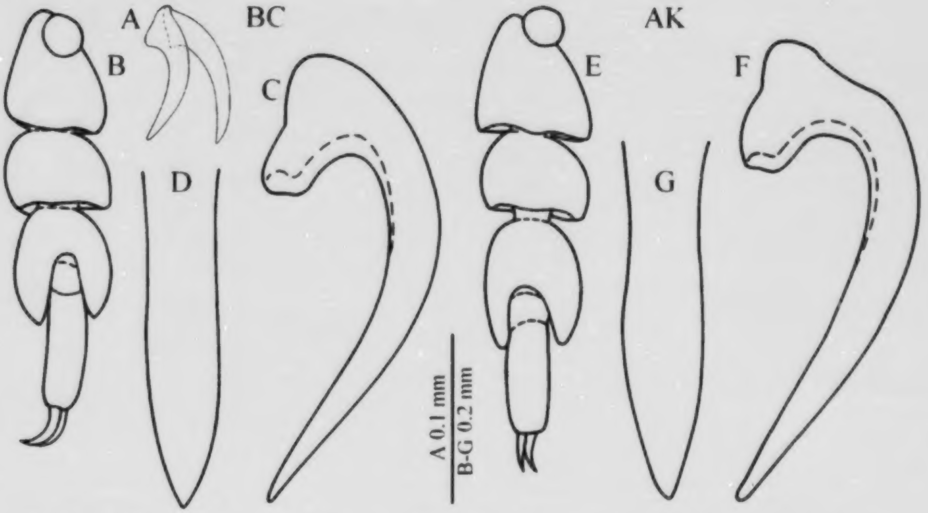


Fig. 96. *Hydroporus longiusculus* male. A - protarsal claws, anterior. B,E - protarsus. C,F - aedeagus, lateral. D.G - aedeagus apex, ventral. BC - specimen from southern British Columbia (*H. fatigus* Gordon). AK - specimen from coastal Alaska (typical *H. longiusculus*).

Hydroporus longiusculus Gemminger and Harold 1868: 436. New name for *H. oblongus* Aubé.

Hydroporus californicus Gordon 1981: 118. Type locality - California, Mono Co., ridge S of Leavitt Meadow, altitude 7500 ft. Holotype in CASC, examined. NEW SYNONYMY.

Hydroporus fatigus Gordon 1981: 119. Type locality - British Columbia, Abbotsford, roadside ditch. Holotype in CASC, examined. NEW SYNONYMY.

Selected References. Sharp 1882*a*: 469; Fall 1923: 86; Hatch 1953: 207; Gordon 1981: 118 – 121.

Description. Length = 3.4 to 4.3 mm, width = 1.5 to 2.1 mm, length: width = 1.93 to 2.11. Body relatively elongate, subparallel, widest at or slightly behind middle; lateral outline continuous in dorsal aspect.

Color mainly piceous to black. Head dorsally mainly piceous to black except frontal bar and anterior and medial portions of clypeus reddish; head ventrally rufous to piceous, genae darker than gula; antenna infuscate from antennomere 3 or 4 to 11; palpi reddish basally with apical palpomere of each palpus infuscate. Pronotum black with anterolateral angles and lateral margins rather broadly rufous. Elytron dark brown to piceous medially, lateral margin brownish yellow with pale area expanded on shoulder and on many specimens as a subbasal transverse band, some specimens with additional pale lateral markings near middle and subapically; epipleuron reddish brown. Ventral surface mainly black. Legs rufous to piceous.

Head with punctures of varied size, largest medially between eyes. Pronotum and elytron moderately to relatively coarsely punctate, pronotum medially with

FJ

somewhat varied, small, widely spaced setiferous punctures, punctures coarser and denser towards margins. Elytron with punctures subequal to coarse pronotal punctures, separated by about one and one half to two times their own diameters, each bearing a fine seta of length one and one half to two times distance between punctures; epipleuron with widely spaced, distinct punctures. Metasternal wing with punctures deep and relatively widely separated; metacoxal plate with punctures slightly smaller and more even in size and distribution; sterna 1 and 2 laterally with punctures similar to those of metacoxal plate; sternum 6 with punctures small and sparse, slightly deeper and denser medioapically. Dorsal surface reticulate but lines shallow and body rather shiny, especially on some males; female with sculpture similar to that of male or slightly deeper but body not matte; metacoxal plate coarsely reticulate.

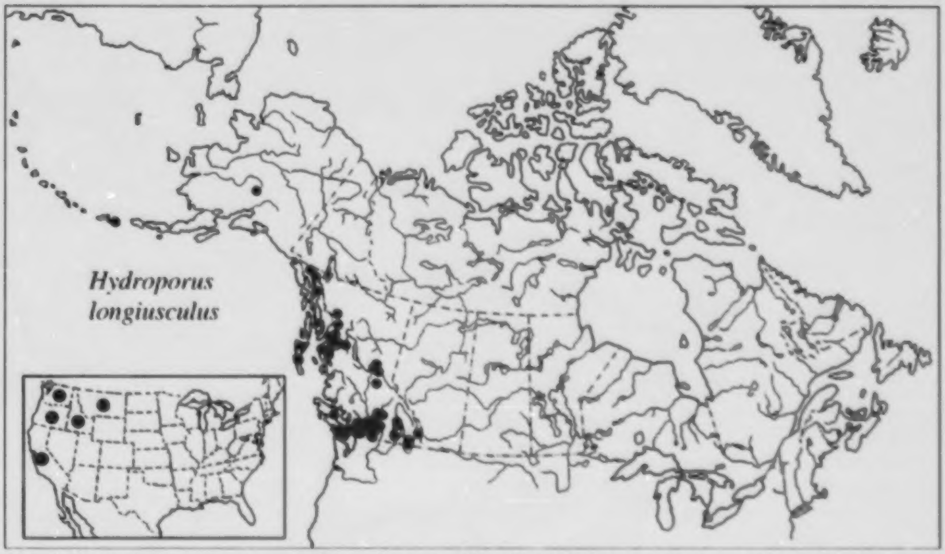
Pronotum with lateral bead moderately narrow, distinctly limited; posterolateral angle slightly produced, right angled to acute, base bisinuate each side of medial lobe, slightly emarginate mesad to posterolateral angle; pronotum in lateral aspect with lateral margin more or less straight. Elytron with lateral margin broadly ascendant basally in lateral aspect. Prosternum with file evident, prominence low and obtusely angulate in lateral aspect, blade elongate, tectiform and pointed apically. Protibia with anterior face bearing a complete longitudinal row of punctures as well as a few punctures basolaterally which on many specimens form an irregular, short basal row so that series appears double or irregularly broken basally. Metacoxal processes conjointly with hind margin narrowly but distinctly produced and angulate at midline.

Male protibia width = 0.17 to 0.18 mm, protarsal ratio = 0.78 – 0.79: 0.74 – 0.79: 0.66 – 0.70 (Fig. 96B, E); protarsal claws (Fig. 96A) subequal in length, anterior claw slightly broader than posterior. Aedeagus (Fig. 96C, D, F, G) slender in lateral aspect, apex not or only slightly sinuate, in dorsal aspect slightly constricted medially.

Comments. The synonymy proposed here is based on specimens sharing a similar unique pattern of punctation of the protibia, medially angulate metacoxal processes, a similar elongate habitus and generally similar form of male protarsus and aedeagus. We judge *H. fatigus* Gordon to be a subjective synonym of *H. californicus* Gordon with the name *H. californicus* having page priority over *H. fatigus*. The holotype of *H. californicus* is rather shiny dorsally due to lightly impressed microreticulation and the setae are brown. While slightly unusual in appearance, similar specimens have been seen from elsewhere in the range of this species. Specimens typical of *H. longiusculus* differ from those of the other nominate species primarily in slightly smaller size and more strongly developed elytral maculation. Apparently *H. longiusculus* represents a more strongly maculate northern coastal form of a widespread Cordilleran species, of which *H. californicus* is the southern and inland form. The two forms merge into one another along the southern British Columbia coast and in inland localities so that no line of demarcation between them can be drawn.

Ecology. This is a lentic species that occurs among emergent vegetation at the margins of small pools and ponds. Specimens occur in both grassland and forest pools but do not seem to occur into the alpine zone, at least in the Canadian part of the range; however, the type of *H. californicus* was collected at 2286 m (=7500 ft.) elevation in California.

Distribution. Map 112. The range extends from Alaska south along the Pacific coast to California and east to eastern British Columbia and western Montana.



Map 112. *Hydroporus longiusculus* Gemminger and Harold. Canadian and Alaskan collection localities and United States state records.

Hydroporus subpubescens-group
Fig. 97

Moderately large species, length = 3.8 to 5.2 mm; body elongate-oval, lateral outline in dorsal aspect continuous or very slightly discontinuous. Head and pronotum piceous to black, elytra more or less distinctly paler, brown to piceous, in most specimens. Pronotum medially with sparse, intermixed coarse and fine punctures. Pronotum with lateral bead well defined; posterolateral angle slightly obtuse and narrowly rounded; lateral margin straight on anterolateral angle. Elytron in lateral aspect with lateral margin ascending. Prosternum with file present; prominence evident, obtuse to tuberculate. Protibia with anterior face bearing a single, coherent row of punctures. Male protarsomeres moderately to broadly dilated, tarsomere 1 with two pairs of scales beneath; protarsal claws little modified, anterior very slightly shorter and broader than posterior. Aedeagus in lateral aspect with apex narrow, slightly sinuate.

This group contains four species restricted to the western Cordillera, from southern British Columbia to California and Arizona. Within the group are two relatively small, northerly species (*H. hirtellus* and *H. similaris*) and two larger, more southerly species (*H. simplex* and *H. subpubescens*). Within each of these pairs, one has narrow male protarsi and the other broad. There is no doubt that within each sympatric pair, the species are distinct. However, it is possible that the pairs with narrow (*H. hirtellus* and *H. simplex*) and broad (*H. similaris* and *H. subpubescens*) male protarsi may each be a single variable species with smaller northern and larger southern members. We have seen too few specimens to ascertain if such a pattern of geographical variation exists.

41. *Hydroporus hirtellus* LeConte 1852

Fig. 97H, I

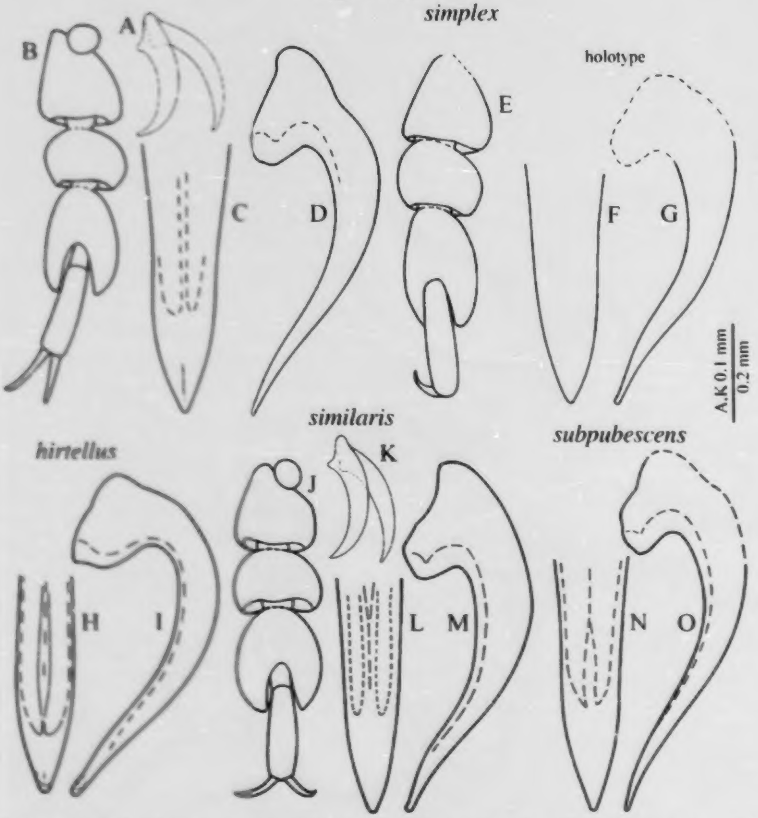


Fig. 97. *Hydroporus subpubescens*-group, male. A – G - *H. simplex* (E – G - holotype). A - protarsal claws, anterior. B,E - protarsus. C,F - aedeagus apex, ventral. D,G - aedeagus lateral. H – I - H hirtellus. H - aedeagus apex, ventral. I - aedeagus, lateral. J – M - *H. similaris*. J - protarsus. K - protarsal claws, anterior. L - aedeagus apex, ventral. M- aedeagus, lateral. N – O - *H. subpuescens*.N - aedeagus apex, ventral. O - aedeagus, lateral.

Hydroporus hirtellus LeConte 1852: 208. Holotype, female in MCZC, on pin with gold disc. Type locality given as California. Type, MCZC Type 6021, examined.

Hydroporus perplexus Sharp 1882a: 467. Type locality California. Type in BMNH, not seen. Synonymy by Fall 1923.

Selected References. Fall 1923: 84; Hatch 1953: 207; Leech and Chandler 1956: 318.

Description. Length = 3.7 to 4.6 mm, width = 1.7 to 2.3 mm, length: width = 1.93 to 2.03. Body ovate, widest at middle of elytra and evenly rounded posteriorly; lateral outline continuous in dorsal aspect.

Head dorsally piceous to black with anterior margin of clypeus and frontal bar, reddish; ventrally with genae piceous to black on most specimens, but some specimens with ventral surface yellow brown; antenna pale basally, outer antennomeres infuscate; palpi yellow, infuscate apically. Pronotum piceous to black medially, paler laterally.

Elytron brown to piceous, paler than disc of pronotum on many specimens. Ventral surface mainly black with lateral margins of sterna 3 to 6 reddish. Legs pale brown, femora darker basally.

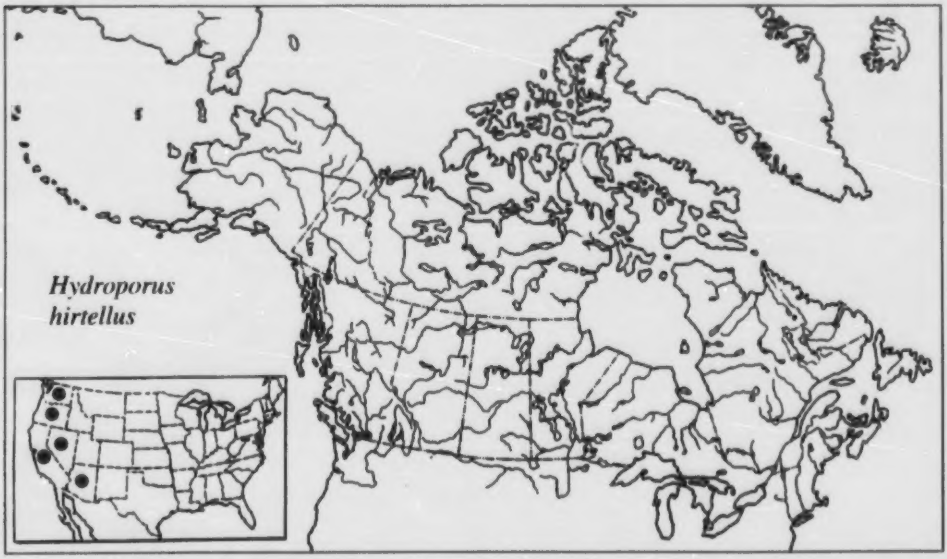
Pronotum medially with sparse intermixed moderate sized and less numerous fine punctures, laterally and basally punctures coarser and separated by about their own diameters. Elytron with punctures similar to those of base of pronotum, separated by one to one and one half times their own diameter. Metasternal wing and sterna 1 and 2 with punctures coarse and narrowly separated, metacoxal plate with punctures slightly smaller and more regularly distributed. Sternum 6 with small deep punctures, separated but somewhat crowded along hind margin. Dorsal surface microreticulate but shiny; similar in both sexes.

Pronotum with lateral bead well delimited and of moderate width; posterolateral angle slightly obtuse with apex narrowly rounded;. Elytron in lateral aspect with lateral margin ascendant to humeral angle. Prosternal file with several evident transverse ridges, prominence evident but low and obtuse. Protibia with a single longitudinal row of punctures on anterior face. Metacoxal processes conjointly with hind margin truncate or very slightly produced.

Male protarsus relatively narrow, width of protarsomere 1 = 0.14 – 0.16 mm, protarsal ratio = 0.74: 0.74: 0.65; protarsal claws about half length of apical protarsomere, anterior claw slightly broader and shorter than posterior. Aedeagus (Fig. 97H, I) in dorsal aspect slightly and broadly constricted medially, narrowed in apical quarter to a blunt point.

Ecology. British Columbia specimens have been collected from amongst emergent grasses at the edge of small forest pools.

Distribution. Map 113. The species occurs from southwestern British Columbia south to California and east to Nevada and Arizona.



Map 113. *Hydroporus hirtellus*. Canadian and Alaskan collection localities and United States state records.

42. *Hydroporus simplex* Gordon 1981

Fig. 97A – G

Hydroporus simplex Gordon 1981: 114. Holotype, male in CASC labelled: Pinecrest, Cal., Tuolumne Co., 13-VII-1948, P.H. Arnaud/ HOLOTYPE Hydroporus simplex Robert Gordon (red label). Type examined.

Description. Length = 4.4 to 5.0 mm, width = 2.3 to 2.5 mm, length: width = 1.94 -2.0. Body elongate oval, widest at middle of elytra and rounded posteriorly; lateral outline continuous in dorsal aspect.

Head dorsally piceous with anterior clypeal margin and frontal bar, reddish; ventral surface reddish or with genae infuscate; palpi reddish, apical palpomere of each palpus infuscate; antenna reddish basally, distal antennomeres infuscate. Pronotum rufopiceous to black medially, lateral margins diffusely paler. Elytron reddish brown laterally and basally, darker medially and apically; epipleuron brown. Ventral surface with prothorax reddish to piceous, meso- and metathorax mainly piceous to black, abdomen reddish to black with a pale sublateral spot on each side of sterna 3 to 5. Legs reddish with femora basally and medially and tarsi, darkened.

Head distinctly punctate with punctures deepest and densest medially on frons. Pronotum medially with intermixed coarse and fine punctures, punctures irregularly and widely spaced, on average separated by two times or more their diameter, laterally punctures coarser and nearly contiguous. Elytron densely punctate, punctures equal in size to basal pronotal punctures, separated by about their own diameters; each puncture bearing a seta slightly longer than distance between punctures; epipleuron distinctly punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum; metacoxal plate with punctures large and dense, separated by about their own diameter or more, subequal in size to those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures small but deep, densest medioapically. Microreticulation of dorsal surface evident but surface shiny in both sexes.

Pronotum with lateral bead well defined, broad; lateral margin in lateral aspect straight on anterolateral angle; posterolateral angle slightly obtuse; basal margin shallowly sinuate on each side of posteromedial lobe. Elytron with lateral margin in lateral aspect ascendant to humeral angle; epipleuron not visible to shoulder. Prosternum not modified; process with declivity well developed, file evident, prominence with a small medial tubercle; blade pointed apically. Protibia with anterior face with a single coherent row of punctures. Metacoxal processes conjointly with hind margin truncate to very slightly angulate.

Male protarsomeres (Fig. 97B, E) relatively narrow, protarsomere 3 parallel-sided, narrower than 1 and 2; protibia width = 0.20 to 0.22 mm, protarsal ratio = 0.76: 0.77: 0.69; pro- and mesotarsomere 1 each with two pairs of small ovate scales on ventral surface; protarsal claws (Fig. 97A) slender, anterior claw slightly shorter, broader and more arcuate apically than posterior, claws half length of apical protarsomere. Aedeagus (Fig. 97C, D, F, G) in dorsal aspect parallel sided, narrowed to a blunt point in apical quarter; in lateral aspect apex slightly sinuate.

Comments. Our measurements of length differ considerably from those given by Gordon (1981). The measurements Gordon gave for the length and width of the holotype are 5.25 by 2.80 mm whereas our measurements are 4.96 by 2.52 mm. The measurements in the description are our measurements of the holotype and 11 specimens from Donner's Summit, Nevada Co., California. The protarsus and aedeagus of the holotype are compared with those of a specimen from Donner's Summit in Fig. 97.

Ecology. Specimens from Donner's summit were collected at 2200 m from amongst *Carex* at the margin of a lake.

Distribution. Specimens were examined from Nevada and Tuolumne Cos. in the central Sierra Nevada Mountains and from the San Bernardino Mountains, California.

43. *Hydroporus similaris* Fall 1923

Fig. 97J – M

Hydroporus similaris Fall 1923: 85. Holotype, male in MCZC, labelled: Corvallis, Oreg./ / TYPE similaris/ M.C.Z. Type 23954 (red label)/ H.C. FALL COLLECTION/ HOLOTYPE, Hydroporus similaris Fall, 1923 (red label). Type examined.

Selected Reference. Hatch 1953: 207.

Description. Length = 3.9 to 4.8 mm, width = 2.0 to 2.3 mm, length: width = 1.93 to 2.05. Body elongate oval, widest near middle of elytra and rounded posteriorly; lateral outline slightly discontinuous in dorsal aspect.

Head dorsally piceous except anterior portion of clypeus and frontal bar, reddish; ventrally with genae reddish to piceous, gula reddish; antenna pale basally, antennomeres 3 or 4 to 11 infuscate; palpi reddish, apical palpomere of each palpus infuscate. Pronotum piceous to black medially, lateral bead and lateral margin narrowly mesad to bead, reddish to piceous. Elytron dark brown to piceous medially, lateral margin and especially humeral angle paler, some specimens with basolateral area pale brown with a diffuse darker pattern on disc consisting of a subhumeral spot and an irregular discal cloud; epipleuron rufopiceous to piceous except humeral angle and outer margin brown. Ventral surface mainly black; sterna 3 to 5 each with a reddish lateral spot. Legs reddish with femora basally and tarsi darker.

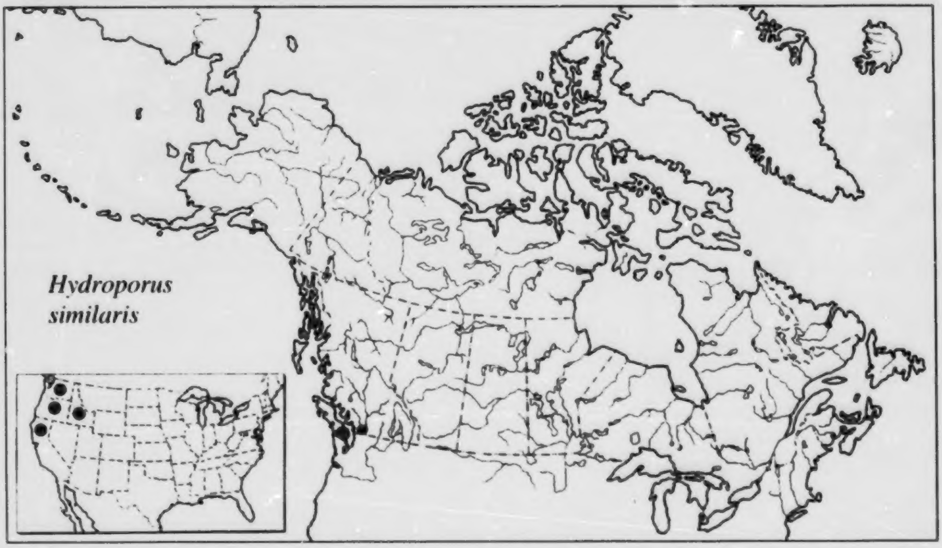
Pronotum medially with intermixed coarse and fine punctures; laterally punctures denser and of more uniform coarse size. Elytron with punctures separated by their own diameters; pubescence fine, brown, setae about one and one half to two times as long as distance between punctures. Metasternal wing and sterna 1 and 2 coarsely punctate, metacoxal plate with punctures slightly sparser and shallower. Sternum 6 with small deep punctures, more or less evenly spaced or denser posteromedially. Body microreticulate in both sexes, shiny.

Pronotum with lateral bead of moderate width, well defined; posterolateral angle narrowly rounded and obtuse; Elytron in lateral aspect with lateral margin ascendant to humeral angle. Prosternum with file well developed, prominence low, broadly obtuse or obsolete in lateral aspect. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly with apex truncate to faintly angulate.

Male protarsus (Fig. 97J) moderately dilated, protarsomeres 1 and 3 subequal in width, 2 slightly broader; protibia width = 0.16 to 0.19 mm, protarsal ratio = 0.82: 0.89: 0.84; protarsomere 1 with two pairs of scales on ventral surface; protarsal claws (Fig. 97K) slightly differing, anterior claw broader and subequal to or slightly shorter than posterior; claws about one half length of apical protarsomere. Aedeagus (Fig. 97L, M) in dorsal aspect with sides nearly parallel medially, narrowed to a point in apical quarter; apex in lateral aspect slightly sinuate.

Ecology. The habitat has not been described.

Distribution. Map 114. The range extends from southern B.C. and Idaho to southern Oregon.



Map 114. *Hydroporus similaris* Fall. Canadian and Alaskan collection localities and United States state records.

44. *Hydroporus subpubescens* LeConte 1852

Fig. 97N, O

Hydroporus subpubescens LeConte 1852: 208. Holotype - male in MCZC labelled: [gold disc]/ MCZC Type 6020. Type locality given as San Francisco, California. Type examined.

Selected References. LeConte 1855: 292; Crotch 1873: 394; Sharp 1882*a*: 467; Fall 1923: 79; Hatch 1953: 206; Leech and Chandler 1956: 317.

Description. Length = 4.6 to 5.2 mm, width = 2.4 to 2.8 mm, length: width = 1.84 to 1.97. Body ovate, widest at middle of elytra and rounded posteriorly; lateral outline continuous in dorsal aspect.

Head piceous with frontal bar and anterior margin paler; ventral surface reddish except genae infuscate; antenna pale basally, antennomeres 3 or 4 to 11 infuscate; palpi infuscate apically. Pronotum piceous to black medially, lateral margins diffusely paler.

Elytron brown to piceous with base and humeral angle paler. Ventral surface mainly black, abdominal sterna 3 to 5 each with a reddish sublateral spot on each side, sternum 6 reddish laterally, or some specimens with abdomen largely reddish. Legs reddish, femora darkened basally.

Head with punctures fine and dense, punctures smaller and sparser on vertex and clypeus. Pronotum medially with punctures of varied size, larger punctures irregularly and sparsely distributed, punctures of more uniform size, denser and coarser laterally and posteriorly, some punctures longitudinally confluent on posterolateral angle. Elytron with punctures larger than those medially on disc of pronotum, moderately dense and separated by about two times their diameter; each puncture bearing a yellowish seta about one and one half to two times as long as distance between punctures; epipleuron sparsely, finely punctate. Metasternum laterally, metacoxal plate and sterna 1 and 2 laterally coarsely punctate, punctures coarsest on metasternum laterally; metacoxal plate with punctures large and moderately dense, separated by about one to one and one half times their own diameter, subequal in size to or a bit smaller than those of abdominal sterna 1 and 2 laterally; sternum 6 with punctures moderately coarse, somewhat crowded medioapically. Microreticulation evident in both sexes, female with sculpture denser and surface duller.

Pronotum with lateral bead complete and well delimited; lateral margin in lateral aspect straight on anterolateral angle and not exposing epipleuron; posterolateral angle about right angled to obtuse; basal margin slightly sinuate on each side of posteromedial lobe. Elytron with lateral margin broadly ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum not modified; process with prominence and file well developed; blade quite narrow and elongate, narrowly rounded apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male with protarsomeres 1 to 3 rather broadly dilated; protibia width = 0.22 mm, protarsal ratio = 0.85: 0.95: 0.85; protarsomere 1 with three and protarsomere 2 with one pair of larger, oval scales on ventral surface; protarsal claws subequal in length, anterior claw slightly broadened and more arcuate at apex than posterior claw. Mesotarsomeres 1 to 3 broad, subequal in width, mesotarsomere 3 cordate. Aedeagus (Fig. 97N, O) in dorsal aspect with sides parallel medially, tapering to a point in apical quarter; in lateral aspect tip sinuate.

Comments. Some specimens in series that seem to be *H. similaris* are within the lower size range of *H. subpubescens*. Such specimens are almost indistinguishable from *H. subpubescens* but tend to have more rounded posterolateral pronotal angles, narrower pronotal bead and some specimens have the elytra pale basally with vague darkened maculations on the humeral angle and basomedial portions of the disc.

Ecology. The species is lentic, occurring amongst emergent vegetation or plant debris at the margins of pools, small ponds or quiet pools of very slow, small streams.

Distribution. This species occurs along the Pacific coast from Puget Sound, Washington, to California. There are no Canadian records but it is likely the species occurs in southwestern British Columbia.

Hydroporus sinuatipes-group
Fig. 98

Similar to members of the *H. subpubescens*-group, differing, primarily in sexual characters. Length = 4.9 to 5.9 mm; body elongate-oval, lateral outline discontinuous in male, less so in female; dorsal surface relatively densely punctate and setose; male protarsomeres broadly dilated; male protibia with a ventrobasal emargination, present also on female but shallower. Aedeagus in lateral aspect with apex not sinuate.

This group contains a single Pacific Coast species of uncertain affinities. In general appearance it is most similar to members of the *H. subpubescens*-group but there is no synapomorphy to support this.

45. *Hydroporus sinuatipes* Fall 1923
Fig. 98

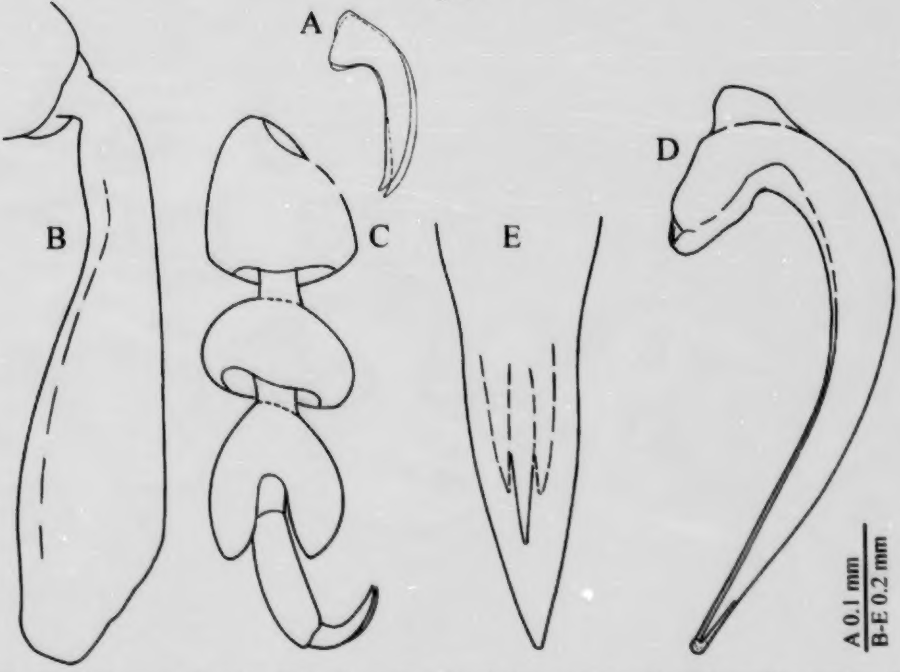


Fig. 98. *Hydroporus sinuatipes* Fall. A - male protarsal claws, anterior. B - male protibia, anterior. C - male protarsus, dorsal. D - aedeagus, lateral. E - aedeagus apex, ventral.

Hydroporus sinuatipes Fall 1923: 74. Type - male in MCZC labelled: Corvallis, 4.27 Oreg/ TYPE sinuatipes/ M.C.Z. Type 23955/ H. C. FALL COLLECTION/ HOLOTYPE Hydroporus sinuatipes Fall 1923 (red label). Type examined.

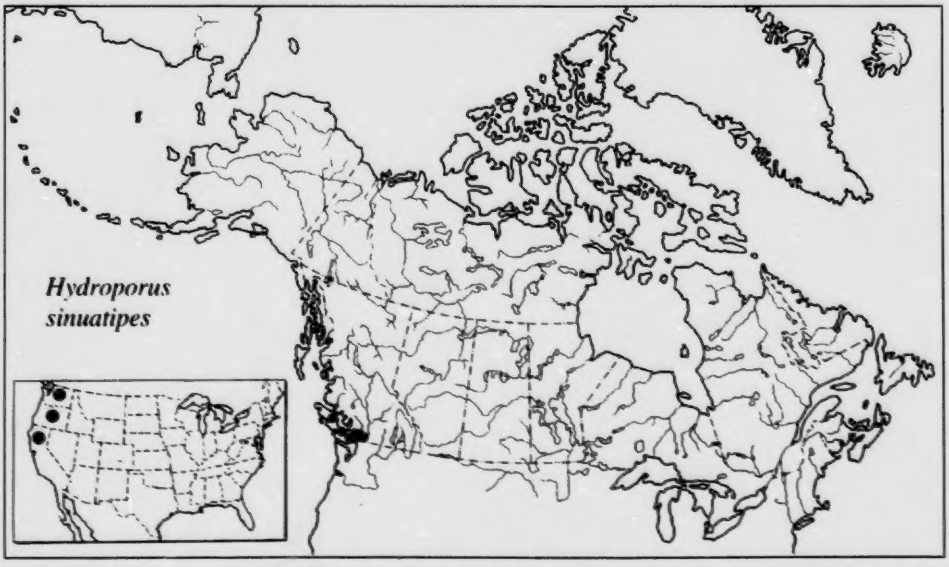
Selected References. Hatch 1953: 206; Leech and Chandler 1956: 317.

Description. Length = 4.9 to 5.9 mm, width = 2.5 to 3.0 mm, length: width = 1.90 to 1.99. Body ovate, widest at middle and rounded posteriorly. Pronotum of male broad, lateral margin more arcuate than that of elytron and therefore lateral outline of body discontinuous in dorsal aspect; pronotum of female narrower and lateral outline much less discontinuous.

Color dark brown to black, some specimens distinctly paler at base of elytra. Head dorsally black with frontal bar and anterior margin, red; head ventrally dark reddish. Antenna pale basally, outer antennomeres infuscate apically; palpi with apex of apical palpomeres infuscate. Pronotum piceous to black with lateral margins faintly paler. Elytron dark brown to piceous with ill-defined yellow basal fascia on some specimens; epipleuron reddish. Ventral surface mainly black. Legs reddish.

Head with punctures small and dense, punctures smaller and sparse on vertex and clypeus. Pronotum medially with punctures fine and dense and of two sizes, punctures somewhat denser on posterolateral angle. Elytron with punctures fine, smaller than those on disc of pronotum, punctures separated by about one to one and one half times their own diameter, each bearing a yellow seta, seta two times as long as distance between punctures; epipleuron very finely, sparsely punctate. Metasternum laterally and sterna 1 and 2 laterally coarsely punctate, punctures on metacoxal plate smaller, shallower and more widely spaced, separated by about three times their own diameter, smaller in size than those of abdominal sterna 1 and 2 laterally; sternum 6 sparsely punctate, punctures a little denser apically but not crowded. Microreticulation well developed, female with sculpture stronger and denser than on male.

Pronotum with lateral bead narrow but distinct, not inflated on anterolateral angle; lateral margin in lateral aspect straight on anterolateral angle not exposing epipleuron; posterolateral angle in male more or less right angled and in female obtuse; basal margin sinuate on each side of posteromedial lobe. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum modified, raised laterally and anteriorly with medial depression at base of process distinct; process with declivity well developed, prominence and file well developed; blade narrow and elongate, bluntly pointed apically, blade convex but convexity lower than in related species. Protibia with a single row of punctures on anterior face. Male protibia (Fig. 98B) with ventral margin shallowly but distinctly emarginate sub-basally so that ventral



Map 115. *Hydroporus sinuatipes* Fall. Canadian and Alaskan collection localities and United States state records.

margin is distinctly sinuate in anterior aspect; female protibia perceptibly but much less distinctly sinuate in same region. Metacoxal process conjointly with hind margin truncate. Metasternum and metacoxa in lateral aspect straight or even slightly concave along mid line in lateral aspect.

Protarsomeres 1 to 3 broadly dilated (Fig. 98C), protibia width = 0.24 mm, protarsal ratio = 1.0: 1.0: 0.9; protarsal claws (Fig. 98A) subequal in length, similar in shape with ventral margin more or less straight medially, dorsal margin evenly arcuate. Aedeagus (Fig. 98D, E) in lateral aspect narrow, apex blunt: in dorsal aspect slightly constricted medially, evenly narrowed in apical third to blunt point. Female protibia with ventral sinuation present but less well developed than on male.

Ecology. Specimens have been collected from along the margins of ponds where they occur amongst plant debris, sedges, cattails and algae.

Distribution. Map 115. The range extends from southwestern British Columbia along the Pacific Coast to California.

Hydroporus nigellus-group
Figs. 99 – 105

This is a poorly characterized group of medium sized species, L = 3.0 to 5.0 mm. Color of head, pronotum and ventral surface mainly black, elytra rufous to black, without distinct pale markings. Punctation various, most specimens with intermixed coarse and fine punctures medially on pronotum. Pronotum with lateral bead very narrow to moderate, lateral margin straight in lateral aspect. Elytron distinctly ascendant to humeral angle. Protibia with longitudinal row of punctures on anterior face single. Metacoxal processes conjointly with hind margin truncate to faintly angulate medially.

This group is based primarily on negative characters, that is it is comprised of median sized species that lack the defining characteristics of other groups. Because of this, the group is likely polyphyletic. A few of the species, such as *H. rectus* and *H. gossei*, are easily recognized. However, lack of distinctive characteristics also makes definition of some of the species very difficult. Characters such as size, shape, vestiture, depth and density of punctation and dilation of male protarsi vary between populations but it is not evident whether all this variation indicates the presence of a group of species or rather only a few polytypic species. Because much of this variation is subtle, characters do not always covary and it is difficult to relate the various forms between localities, we have not been able to define several of the species in a manner with which we are satisfied. However, a preliminary attempt at numerical analysis of the species appears promising (Nilsson 1994). Within the genus, this is the group for which the need for taxonomic studies is most pressing.

46. *Hydroporus tartaricus* LeConte 1850
Fig. 99

Hydroporus tartaricus LeConte 1850: 215. Lectotype, male in MCZC, designated by Nilsson 1994, MCZC Type 6026. Type locality - Lake Superior. Type examined.

Hydroporus elusivus Gordon 1981: 121 - 122. Holotype, male in MCZC, labelled: Rumney, N.H., iv.22 1926, Darlington/ tartaricus Lec (or near) P.J.D. I.5.27/ Hyd. tartaricus Lec.? Comp. type P.J.D. I.10.'27: This is darker, broader, more heavily

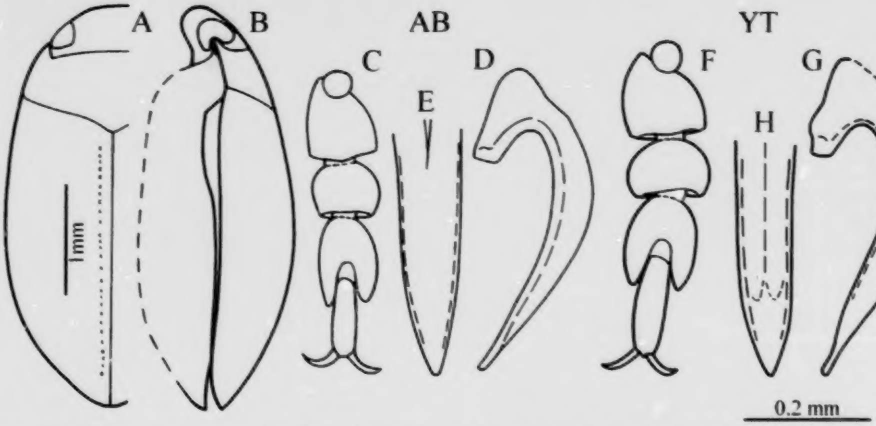


Fig. 99. *Hydroporus tartaricus* male. A - left body outline, dorsal. B - body outline, lateral. C,F - male protarsus. D,G - aedeagus, lateral. E,H - aedeagus apex, ventral. AB - specimen from Alberta (= *H. tartaricus* sensu Larson 1975). YT - specimens from Yukon Territory (typical *H. tartaricus*).

punct., less (a little) continuous, alutacion less evident, smaller: Note: Fall: R.p.86/ Museum of Comparative Zoology/ HOLOTYPE Hydroporus elusivus Robert Gordon (red label). (Note: holotype lacking both antennae beyond antennomere 2, left protarsomere 5 missing, genitalia in a microvial on the pin). Type examined. NEW SYNONYMY.

Selected References. Fall 1923: 86; Larson 1975: 313 – 314; Nilsson 1994: 94; Hilsenhoff 1995: 14.

Description. Length = 3.1 to 3.6 mm, width = 1.6 to 1.9 mm, length: width = 1.89 to 2.02. Body (Fig. 99A, B) oblong-oval, widest near or slightly behind middle; lateral outline continuous in dorsal aspect.

Color dark brown to piceous. Head dorsally rufopiceous to piceous with frontal bar and anterior margin paler; ventrally testaceous to rufopiceous, gula color various, concolorous with or paler than genae or distinctly infuscate and darker than genae on some specimens; antenna with basal 3 or 4 antennomeres yellow, outer antennomeres infuscate; palpi yellow to reddish, apical palpomere of each palpus infuscate. Pronotum medially piceous to black, lateral margins broadly reddish and gradually darkened mesally on disc. Elytron dark brown to piceous medially and apically, shoulder and lateral margin paler, brown; epipleuron brown to reddish, inner margin infuscate. Ventral surface mainly piceous to black except proepipleuron, apex of metacoxal processes and sterna 3 to 5 laterally and sternum 6 apically, reddish. Legs reddish, femora variously infuscate.

Punctation various, size and depth of punctures varying between specimens. Head with punctures of varied size, some relatively coarse. Pronotum punctate over entire disc, medially with intermixed larger setiferous and smaller nonsetiferous punctures; punctures larger and denser laterally and posteriorly. Elytron with punctation various, punctures smaller than to subequal to those on base of pronotum, separated by about two times their own diameter, each bearing a fine, brown seta, seta about as long as distance between punctures; epipleuron with sparse shallow punctures. Metasternum laterally with coarse, separated punctures; metacoxal plate with punctures slightly to distinctly smaller, regularly distributed and separated by about two or more times their own diameters; sterna 1 and 2 with punctures similar in size and density to metacoxal plate. Sternum 6 finely and sparsely punctate. Dorsal surface microreticulate but density and depth various; males tend to be shinier than females.

Pronotum with lateral bead narrow, obscurely delimited or anteriorly narrowed on some specimens; posterolateral angle about right angled; basal margin more or less straight adjacent to posterolateral angle; lateral margin in lateral aspect straight. Elytron of some specimens with a subsutural longitudinal impression; lateral margin ascendant in lateral aspect, epipleuron not visible to shoulder. Prosternum with file well developed, prominence evident but obtuse in lateral aspect; blade narrow, elongate, pointed apically. Protibia with a single row of punctures on anterior face. Metacoxal process conjointly with hind margin truncate.

Male protibia width = 0.15 mm; protarsus narrow (Fig. 99C, F), width protarsomere 1 = 0.11 mm, protarsomeres 1 and 2 subequal in width, 3 narrower and elongate, protarsal ratio = 0.76: 0.75: 0.65; protarsomere 1 with two pairs and protarsomere 2 with one pair of adhesive scales on ventral surface; anterior protarsal claw slightly broader than posterior. Aedeagus (Fig. 99D, E, G, H) short, length = 0.39 to 0.41 mm, in lateral aspect slightly sinuate apically, with or without a very small apical knob on ventral surface.

Comments. The name *H. tartaricus* has been misapplied frequently and almost all literature references are suspect. Limits between the species *H. tartaricus* and *H. nigellus* are vague at best although there seems to be little doubt that at least two species are included in the complex.

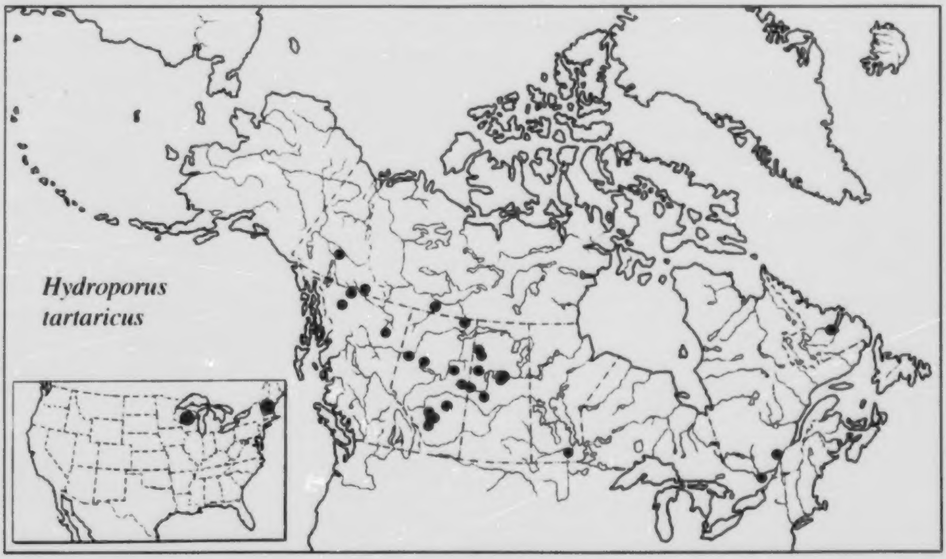
Recognition of *H. tartaricus* has long been problematical because of the lack of distinctive characteristics of the species. The small size and relatively sparse punctation, especially of the metacoxal plate, are the principal diagnostic characters. However, punctation varies considerably so that many specimens are finely and sparsely punctate whereas others have coarser punctures which are similar to those of *H. nigellus*. Size is not a reliable character. Within many series assigned to *H. nigellus* some of the specimens are less than 3.7 mm and lie within the size range given for *H. tartaricus*. Within the range 3.5 to 3.8 mm assignment of single specimens to species is arbitrary, identification generally has to be based on the mean size of specimens in the series. The male protarsus and aedeagus differ slightly in form between *H. tartaricus* and *H. nigellus* but they also vary within each species. When size, aedeagal length and protarsal characters are taken together, a separation of the species can be shown.

Also, there tends to be habitus and color difference between *H. tartaricus* and *H. nigellus*. *Hydroporus tartaricus* specimens are more evenly ovate and depressed than specimens of *H. nigellus*, whereas many specimens of *H. nigellus* are obviously widened behind the middle of the body. *Hydroporus tartaricus* specimens are paler in color for the genae are yellow to dark reddish, the lateral margins of the pronotum reddish and the hind leg less strongly infuscate than in *H. nigellus*. *Hydroporus tartaricus* is a very poorly collected species and little is known of its biology. However, it does not seem to be a typical inhabitant of bogs and tends to be in more eutrophic sites than specimens of *H. nigellus*. Because of these observations we recognize two species but admit we do not understand their limits and caution that the key characters presented will not clearly identify all specimens. Also, specimens of *H. tartaricus* from eastern North America differ slightly in punctation, male genitalia (more evident apical knob) and protarsi from those of the west and are more similar to *H. nigellus* than are western specimens. This problem needs additional investigation when sufficient specimens can be obtained.

Gordon (1981) described *H. elusivus* from four specimens collected at Rumney, New Hampshire. We examined the holotype. Gordon stated that the species differs from *H. tartaricus* in having denser elytral punctation and narrower male protarsi. However, our measurements of the protarsal width of the holotype (protibial width = 0.14 mm, protarsal ratio = 0.75: 0.75: 0.69) do not differ from those of *H. tartaricus*. Our measurements of the holotype (length = 3.24 mm, width = 1.69 mm, length: width = 1.91) also differ from Gordon's (length = 3.40, width = 1.80 mm). The aedeagi of the two species are similar. Aside from the coarser than normal elytral punctation of *H. elusivus*, there seems to be no other character by which it can be separated from *H. tartaricus*. Therefore we regard the name *H. elusivus* as a synonym of *H. tartaricus*.

We have also assigned to this species the specimens Larson (1975) treated as *H. tartaricus* (Fig. 99C - D). In measured characters, they fall within the range of *H. tartaricus* specimens. However, they differ from typical *H. tartaricus* in that the gula is infuscate and darker than the adjacent pale genae (this is the opposite color pattern to that of most *Hydroporus*), the lateral bead of the pronotum is narrowed anteriorly and most specimens have a more or less well developed subsutural stria on each elytron. It is likely that these specimens represent an undescribed species but we refrain from describing it because the few specimens seen (16 from central Alberta) do show some variation and are an inadequate base to determine if the characters are discontinuous between this form and typical *H. tartaricus*.

Ecology. Specimens have been collected from among emergent vegetation, mainly *Carex* or grasses, at the margins of small pools. The beetles are most commonly found in pools amongst or adjacent to deciduous bushes or forest.



Map 116. ***Hydroporus tartaricus*** **LeConte. Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 116. The distribution extends across the boreal region from Labrador to northern B.C. and the Yukon Territory.

47. *Hydroporus nigellus* Mannerheim 1853

Fig. 100

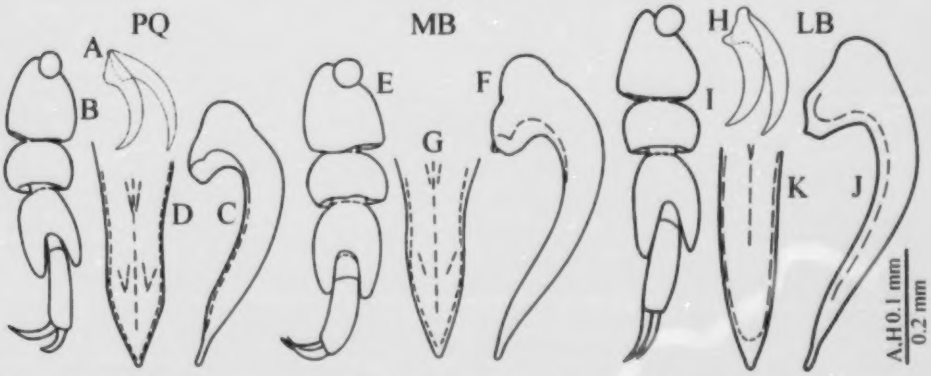


Fig. 100. *Hydroporus nigellus* male. A,H - protarsal claws, anterior. B,E,I - protarsus. C,F,J - aedeagus, lateral. D,G,K - aedeagus apex, ventral. PQ - Quebec. MB - Manitoba. LB - northern Labrador

Hydroporus nigellus Mannerheim 1853: 163. Lectotype, male in ZMHF, from Kenai Peninsula, Alaska; designated by Nilsson (1983*a*). Lectotype not examined .

Hydroporus sp. near *despectus*; Larson 1975: 312.

Selected References. Fall 1923: 83; Balfour-Browne 1940: 302; Hatch 1953: 208; Nilsson 1983*a*: 197; Nilsson 1994 : 89 – 104; Nilsson and Holmen 1995: 55.

Description. Length = 3.0 to 4.1 mm, width = 1.8 to 2.1 mm, length: width = 1.89 to 2.04. Body in dorsal aspect ovate, most specimens with widest point clearly behind middle and more posteriorly than in most species of *Hydroporus*. Pronotum with posterolateral angle not or narrowly rounded, lateral margin not or slightly more arcuate than that of elytron and therefore lateral outline of body continuous or slightly discontinuous in dorsal aspect.

Color piceous to black. Head dorsally piceous to black, except a transverse bar between hind margins of eyes and anterior margin of clypeus and frons, reddish to piceous; head ventrally with genae piceous to black, gula reddish to piceous; antenna dark, antennomeres 2 and 3 infuscate apically, antennomeres 4 to 11 almost entirely piceous; apical palpomere of each palpus piceous. Pronotum black, some specimens with anterolateral angle and lateral bead piceous. Elytron reddish brown to piceous, never fully black, palest basally and laterally with apicomedial portion of disc darkest; epipleuron brown to piceous. Ventral surface mainly black. Legs rufous to piceous, most specimens with hind legs largely infuscate and piceous.

Head with punctures small and sparse, of varied size, denser in frontal furrows. Pronotum medially with punctures notably small and sparse, on most specimens of varied size with larger punctures bearing fine setae; punctures deeper and denser towards margins. Elytron with punctation various, disc ranging from relatively finely and sparsely punctate to rather strongly punctate, punctures generally separated by two times their own diameters or more; setae slightly longer than distance between punctures but very fine, whitish and inconspicuous (rubbed off on many specimens so that disc of elytron appears glabrous and shiny). Metacoxal plate with distinct, evenly distributed punctures of moderate size, separated by about two times their own diameters, these punctures slightly smaller and sparser than punctures of lateral portions of metasternal wings and sterna 1 to 3. Reticulate sculpture present over body of both sexes, but generally lightly impressed and body shiny; most females like males but some slightly duller due to deeper impression of lines.

Pronotum with lateral bead narrow but distinct throughout length; posterolateral angle narrowly rounded apically, obtuse, base only feebly sinuate laterally; lateral margin straight in lateral aspect. Elytron with lateral margin shortly but distinctly ascendant to humeral angle, epipleuron not visible to shoulder. Prosternum with file well developed, prominence evident but low and obtuse in lateral aspect; process elongate and narrowly convex. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal process with hind margin truncate or slightly angulate medially.

Male protibia width = 0.16 mm, protarsomeres 1 to 3 (Fig. 100B, E, I) narrower than in similar species, protarsomeres 1 and 2 subequal in width, 3 narrow with sides subparallel, more or less straight or slightly arcuate or diverging towards apex; width protarsomere 1 = 0.13 mm, protarsal ratio = 0.85: 0.85: 0.71; protarsal claws (Fig. 100A) subequal in length, anterior claw slightly broadened basally. Aedeagus (Fig. 100C, D, F, G, J, K) relatively short, length = 0.38 to 0.43 mm, sinuate in lateral aspect with tip slightly enlarged as a small knob; in dorsal aspect apex pointed, sides slightly constricted medially.

Comments. Larson (1975) referred to this species as "*Hydroporus* species near *despectus* Sharp". Nilsson (1983, 1994), through examination of type specimens, determined that the correct name is *H. nigellus* Mannerheim. The combination of relatively shiny body with fine punctation on disc of pronotum, elongate oval form with point of maximum width behind middle on most specimens, and piceous brown elytra, give specimens a characteristic appearance that usually permits recognition. The best characters for species recognition are male characters and include the narrow protarsus and short, medially constricted and apically knobbed aedeagus. However even these characters are not distinctive enough to permit all specimens to be correctly identified and in addition they show some variation as indicated in Fig. 100. Identification is best done on a series of male specimens and by using several characters simultaneously.

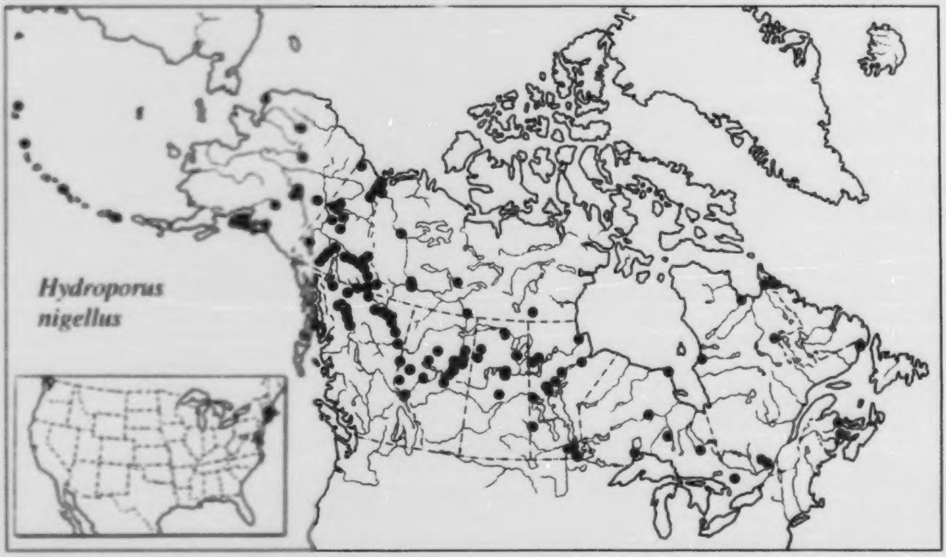
This species is a member of a complex that also includes *H. despectus*, *H. rusticus*, *H. tartaricus*, *H. utahensis*, and *H. elusivus*. *Hydroporus elusivus* and *H. utahensis* are inadequately represented in collections. Gordon's (1981) description of *H. utahensis* indicated that the species should be easily recognized by the relatively strong medial constriction of the aedeagus. However, we did not note this character in our examination of the holotype. The status of *H. elusivus* is discussed above under *H. tartaricus*.

The species *H. nigellus* and *H. geniculatus* are separable primarily on the basis of the shape of male protarsomere 3, this being broader and more quadrate in *H. geniculatus* than in *H. nigellus*. Additionally, *H. nigellus* specimens are slightly different in habitus, being more widened posterior to the middle of the body, and punctation and vestiture being finer on many specimens. However, variation occurs in all of these characters including width of the protarsomeres so that assignment of some specimens to species is arbitrary. In addition, there is variation in *H. nigellus* (see above).

Although differences exist between the species listed above, many specimens have been seen that are intermediate. The problem in distinguishing between *H. tartaricus* and *H. nigellus* is discussed above. In the Yukon Territory series of specimens can generally be placed in either *H. nigellus* or *H. geniculatus* with *H. nigellus* specimens usually being collected in lowland valleys and *H. geniculatus* in subalpine to alpine habitats. However, a few series are comprised of specimens that could be easily assigned to either species and a few of the series of more characteristic specimens still contain the occasional individual that has characteristics of the other species.

Ecology. Specimens of *H. nigellus* are common in the boreal zone in small pools with dense emergent vegetation. The species has been taken from several localities at the boundary of the arctic and boreal zones. Nilsson (1986*b)* described the mature larva based on European material and Alarie (1991) redescribed the mature larva based on Nearctic material.

Distribution. Map 117. The species is Holarctic (Nilsson 1983*a)*. The North American range includes most of the boreal zone and extends north to the southern arctic.



Map 117. *Hydroporus nigellus* Mannerheim. Canadian and Alaskan collection localities and United States state records.

48. *Hydroporus geniculatus* Thomson 1854

Fig. 101A – C

Hydroporus geniculatus Thomson 1854: 200. Type locality 'Lapponia". Lectotype designation by Nilsson (1983*a*).

Hydroporus despectus; Larson 1975: 311 – 312, not Sharp 1882*a*.

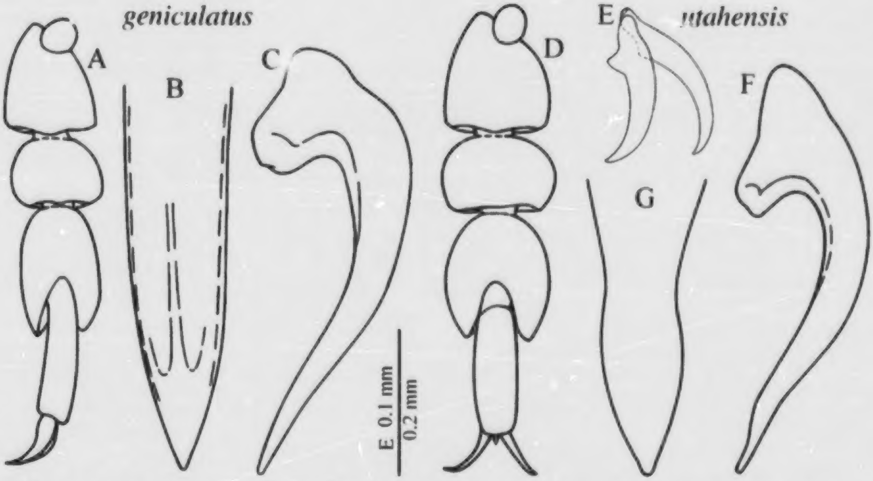


Fig. 101. *Hydroporus* male. A – C - *H. geniculatus*. A - protarsus. B - aedeagus apex, ventral. C - aedeagus, lateral. D – G - *H. utahensis*. D - protarsus. E - protarsal claws, anterior. F - aedeagus, lateral. G - aedeagus apex, ventral.

Selected References. Larson 1975: 311 – 312 (as *H. despectus*); Nilsson 1983*a*: 197 – 202; Nilsson 1994: 89 – 104; Nilsson and Holmen 1995: 55 – 56.

Description. Length = 3.4 to 4.3 mm, width = 1.8 to 2.1 mm, length: width = 1.90 to 2.06. Body subparallel, widest near or slightly behind middle; lateral outline continuous in dorsal aspect.

Color mainly black. Head dorsally black except frontal bar reddish, anterior margin of clypeus dark reddish to piceous; head ventrally with genae piceous to black, gula reddish to piceous; antenna with basal one or two antennomeres yellow, outer antennomeres infuscate; palpi pale except apical palpomere of each palpus infuscate. Pronotum black with lateral margin narrowly piceous on some specimens. Elytron piceous to black medially, lateral margin and shoulder paler, dark reddish to piceous; epipleuron piceous. Ventral surface mainly black. Legs largely piceous with apex of femora and base of tibia, paler; metatarsomeres infuscate.

Pronotum densely and coarsely punctate laterally, medially punctures sparser, with intermixed coarse and small punctures. Elytron strongly punctate, punctures evenly distributed over disc and separated by one and one half to two times their own diameters. Metacoxal plate evenly punctate; metasternal wing with punctures conspicuously larger and denser; sterna 1 and 2 coarsely punctate. Dorsal surface evidently microreticulate, sculpture similar on both sexes or some females with lines slightly deeper than on male but without dense, matte sculpturing.

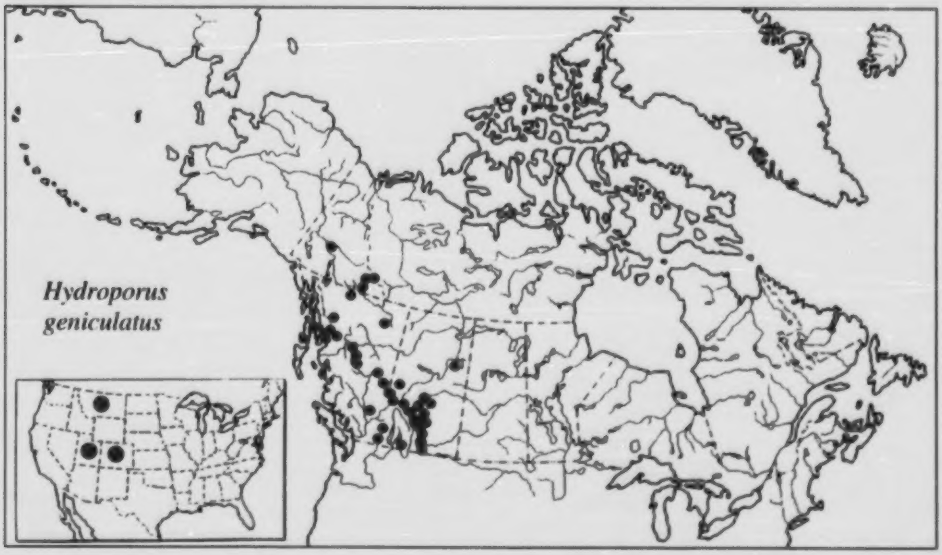
Pronotum lateral bead relatively broad and clearly delimited throughout length; posterolateral angle about right angled; lateral margin straight in lateral aspect. Elytron in lateral aspect with lateral margin ascendant to humeral angle. Prosternum with file well developed; prominence low and broadly obtuse in lateral aspect. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly with hind margin truncate or very slightly projecting medially.

Male protibia width = 0.17 mm; protarsomeres 1 to 3 (Fig. 101A) moderately dilated, width protarsomere 1 = 0.14 mm; protarsomeres 1 and 2 subequal in width, protarsomere 3 narrower with sides subparallel, protarsal ratio = 0.83 : 0.86 : 0.78; protarsomere 1 with two pairs, protarsomere 2 with one pair of oval scales on ventral surface; protarsal claws subequal or anterior claw slightly shorter and broader than posterior. Aedeagus (Fig. 101B, C) short, length = 0.40 to 0.45 mm; in lateral aspect slightly sinuate apically with a small apical knob; in dorsal aspect sides subparallel or very slightly narrowed medially, apically gradually narrowed to blunt apex.

Comments. Nilsson (1994) showed that this is an Holarctic species. Larson (1975) recognized and diagnosed the species but misapplied the name *H. despectus* to it. Fall's (1923) concept of *H. despectus* included both *H. despectus* and *H. geniculatus*. Gordon's (1981) description of *H. utahensis* does not correspond to the holotype in several important ways (e.g., his measurement of length is too large, 4.5 mm versus 4.3 mm; aedeagus said to be constricted medially when this only faintly so) and *H. utahensis* appears to be a synonym of *H. geniculatus*.

Ecology. These beetles occur in small, cold, peaty pools.

Distribution. Map 118. The species is Holarctic. The range is primarily boreal and alpine in northwestern North America. It occurs throughout most of British Columbia (perhaps not reaching the southwestern coast) and western Alberta and north into the Yukon Territory and Alaska. Because of difficulty in identifying the species, we do not know its United States range but specimens similar to those of southern Alberta have been seen from Colorado and Utah.



Map 118. *Hydroporus geniculatus* Thomson. Canadian and Alaskan collection localities and United States state records.

49. *Hydroporus utahensis* Gordon 1981

Fig. 101D – G

Hydroporus utahensis Gordon 1981: 116. Holotype, male in CASC, labelled as follows: Utah Lake East Side/ H. P. Chandler No 196 Exp. 7 6 41 NE, Elev. 4000 SW/ H.B. Leech Collection/ HOLOTYPE, Hydroporus utahensis, Robert Gordon (red label). Holotype examined.

Description. (based on Holotype and 5 specimens, Inyo Co., CA (CASC)). Length = 3.7 to 4.3 mm, width = 1.8 to 2.2 mm, length: width = 1.96 to 2.08. Body elongate oval, widest at middle of elytra and rounded posteriorly; posterolateral angle of pronotum narrowly rounded and lateral outline of body very slightly discontinuous in dorsal aspect.

Color reddish brown to piceous. Head dorsally rufopiceous to piceous except anterior margin and frontal bar, reddish; ventrally genae black, mouthparts and gula reddish; antenna reddish basally with antennomeres 2 or 3 to 11 darkened; palpi infuscate apically. Pronotum reddish brown to piceous medially, broadly and diffusely paler laterally, anterior margin piceous. Elytron reddish to rufopiceous, evidently paler than pronotum; epipleuron piceous medially, outer portion reddish. Ventral surface mainly black. Legs reddish with femora darkened basomedially.

Pronotum medially with fine sparse punctures of varied size separated by at least twice their diameters, laterally and posteriorly punctures larger and denser but clearly separated. Elytron with punctures relatively coarse, similar in size to those on base of pronotum, separated by about one and one half to two times their diameter; setae fine, about one and one half to two times as long as distance between punctures. Metasternal wing, metacoxal plate and sterna 1 and 2 coarsely punctate, punctures of metacoxal plate slightly smaller than those of metasternal wing; sternum 6 with small deep separated punctures. Dorsal surface evidently microreticulate but lines lightly impressed and surface shiny; metasternum medially and abdominal sterna shiny, microsculpture lightly impressed.

Pronotum with lateral bead of narrow to moderate width, well delimited; lateral margin straight in lateral aspect. Elytron in lateral aspect with lateral margin ascendant to humeral angle. Prosternum with file evident, prominence low and obtuse. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly with hind margin truncate or slightly angulate.

Male protibia width = 0.16 to 0.21 mm; protarsomere 1 width = 0.13 to 0.16 mm; protarsomeres 1 and 2 subequal in width and slightly broader than protarsomere 3, protarsal ratio = 0.80: 0.80: 0.70 (Fig. 101D); protarsomere 1 with two pairs of scales on ventral surface; protarsal claws (Fig. 101E) little modified, subequal in length, anterior claw slightly broader basally and more arcuate than posterior. Aedeagus (Fig. 101F, G) in dorsal aspect with a broad medial constriction, apex gradually tapered to a small rounded knob-like tip.

Comments. We know this species only from the holotype and five specimens from Inyo Co, California. The holotype does not correspond very well with Gordon's (1981) description. It is smaller, paler in color, the lateral margin of the elytron is rather strongly ascendant, the ventral reticulation is reduced, and the aedeagus is cracked medially so that the medial constriction is not evident. The California specimens are teneral causing them to be paler than might be the case in mature specimens, the elytral punctures are very distinct and the aedeagi of the two males are poorly sclerotized and damaged therefore the shape cannot be reliably determined. This species needs are careful reevaluation.

Ecology. Not recorded.

Distribution. The species is known from the type series collected at Utah Lake, Utah, and from elevations of 3,300 to 3700 m in Inyo Co, California (CASC).

50. *Hydroporus tenebrosus* LeConte 1850

Fig. 102

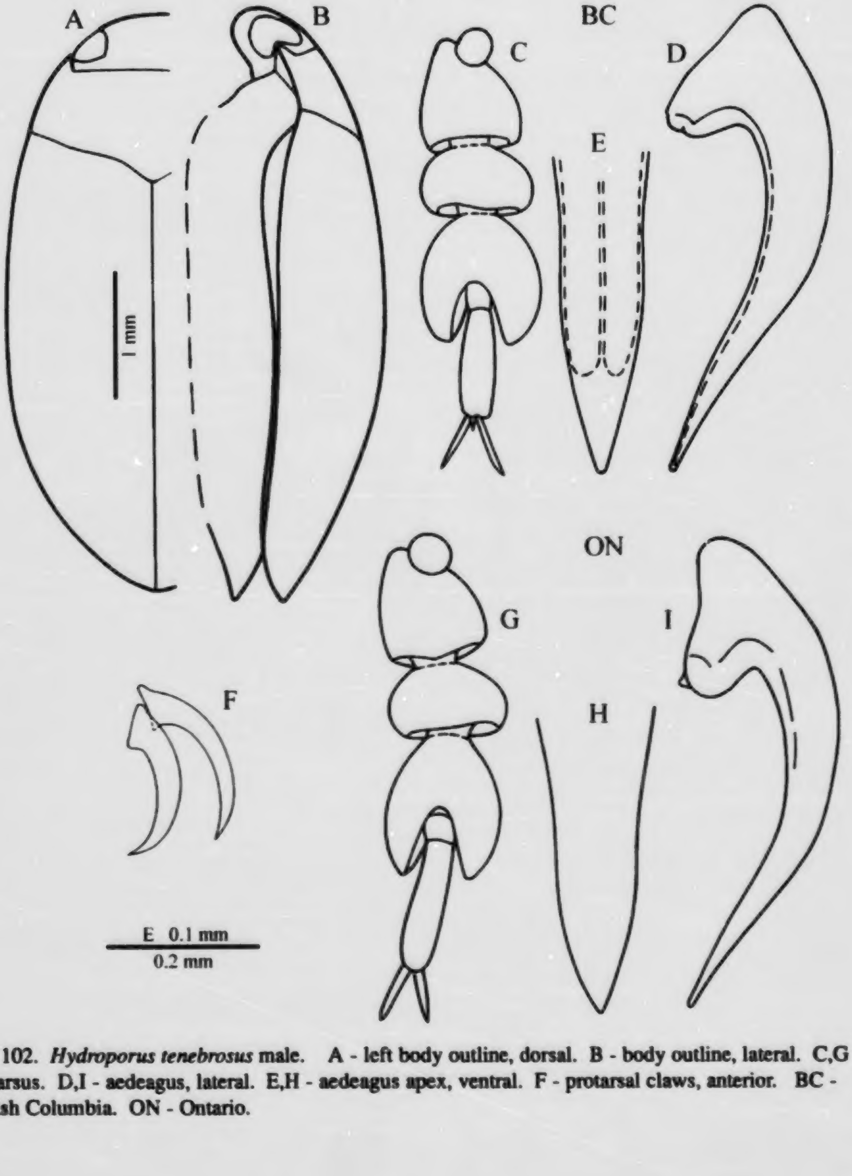


Fig. 102. *Hydroporus tenebrosus* male. A - left body outline, dorsal. B - body outline, lateral. C,G - protarsus. D,I - aedeagus, lateral. E,H - aedeagus apex, ventral. F - protarsal claws, anterior. BC - British Columbia. ON - Ontario.

Hydroporus tenebrosus LeConte 1850: 215. Holotype, male in MCZC, on pin with pale blue disc. Type locality given as Lake Superior. Type, MCZC Type 6023, examined.

Hydroporus luridipennis LeConte 1850: 216. Holotype, male in MCZC, on pin with pale blue disc. Type locality given as Eagle Harbor, Lake Superior. Type, MCZC Type 6022, examined. [not Melsheimer 1844].

Hydroporus lutulentus LeConte 1855: 292. New name for *H. luridipennis* LeConte.

Selected References. Fall 1923:81; Hatch 1953: 207; Anderson 1962: 63; Gordon and Post 1965: 17; Larson 1975: 310; Hilsenhoff 1995: 14 – 15.

Description. Length = 3.5 to 4.3 mm, width = 1.8 to 2.2 mm, length: width = 1.94 to 2.06. Body (Fig. 102A, B) elongate-oval, widest slightly behind middle; lateral outline more or less continuous in dorsal aspect.

Color brown to piceous, at most only pronotal disk black. Head dorsally piceous, except frontal bar, anterior margin of clypeus, and frons above base of antenna, reddish; head ventrally reddish with genae variously infuscate; antenna pale basally, antennomeres 3 to 11 infuscate apically; palpi reddish with terminal palpomere of each palpus infuscate apically. Pronotum with disc piceous to black, anterolateral angle and lateral margin relatively broadly reddish to piceous. Elytron dark brown to piceous medially and apically, lateral margin brown or reddish; epipleuron brown with inner margin piceous. Ventral surface largely piceous to black. Legs reddish except femora basally, tibia apically and externally, and tarsi, darker.

Head with evident but small punctures, deepest and densest medially on frons and sparser anteriorly and laterally. Pronotal disc with dual punctation consisting of coarse setiferous punctures and smaller non-setiferous punctures, punctures denser and larger towards margins. Elytron with small punctures separated by about one and one half times their own diameters, each puncture bearing a long pale seta about twice as long as distance between punctures; epipleuron with small, distinct punctures. Metasternal wing densely and coarsely punctate, metacoxal plate with punctures slightly smaller and more widely and evenly separated; sternum 6 with punctures small and evenly spaced. Reticulate sculpture present over body; male with meshes of more or less even size but irregular shape; female sculpture very dense and fine with surface dull or matte.

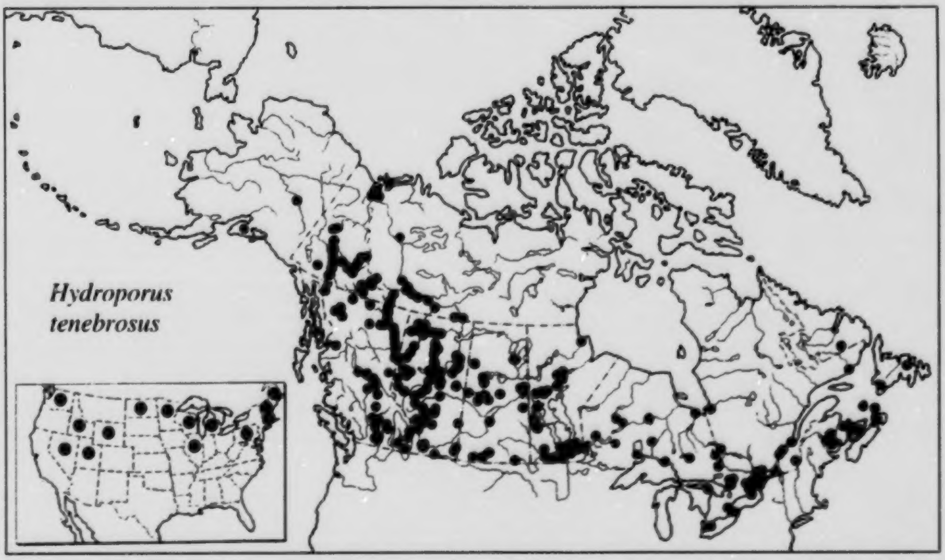
Pronotum with right or slightly obtuse hind angles; lateral bead narrow but distinct throughout length; lateral margin straight in lateral aspect. Elytron with lateral margin slightly and gradually ascendant to humeral angle, epipleuron not visible to shoulder in lateral aspect. Prosternal process with prominence low and broadly obtuse in lateral aspect; file well developed with low transverse ridges. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes truncate or very slightly produced medially.

Male protibia width = 0.19 mm, protarsal ratio = 0.75: 0.80: 0.79; protarsomere 3 broadly oval in outline (length: width = 1.10 to 1.37) and conspicuously robust in comparison with protarsomeres 1 and 2 (Fig. 102C, G); protarsomeres 1 and 2 with two and one pairs of ventral adhesive setae, respectively; protarsal claws (Fig. 102F) subequal in length, anterior claw slightly broader with apex slightly more arcuate than posterior claw; mesotarsomere 3 very large, ovate. Female with pro- and mesotarsomeres 1 to 3 very narrow, tarsomeres 3 narrowly triangular in outline. Aedeagus (Fig. 102D, E, H, I) in lateral aspect evenly narrowed apically, slightly sinuate in apical half.

Comments. Usually specimens of *H. tenebrosus* are easy to recognize for among species of this size range they tend to be of slightly paler color, especially the elytra and ventral surface of the head, the male protarsomeres 3 are relatively large whereas those of the female are very narrow, and females are dull from dense microreticulation. However, all of these characters vary and dark specimens with narrower tarsi (males) or relatively shiny sculpture (females) can be very difficult to place.

Ecology. This species occurs mainly in forested regions but is also common in the prairie parkland. Beetles occur in the emergent zone of small, usually temporary pools and ponds. They are usually found in eutrophic, sun-warmed sites. All larval instars were described by Alarie (1991).

Distribution. Map 119. The range extends from Newfoundland to southern Alaska.



Map 119. ***Hydroporus tenebrosus*** **LeConte. Canadian and Alaskan collection localities and United States state records.**

51. *Hydroporus despectus* Sharp 1882

Fig. 103

Hydroporus despectus Sharp 1882*a*: 466. Lectotype, male in BMNH, selected by Nilsson (1994). Type locality given as "North America (Canada)". Type not examined.

Hydroporus rusticus Sharp 1882*a*: 467. Lectotype, female in BMNH, selected by Nilsson (1994). Type locality given as Nevada. Type not examined.

Selected References. Fall 1923: 81; Hatch 1953: 207; Anderson 1962: 63; Nilsson 1994: 89 – 104.

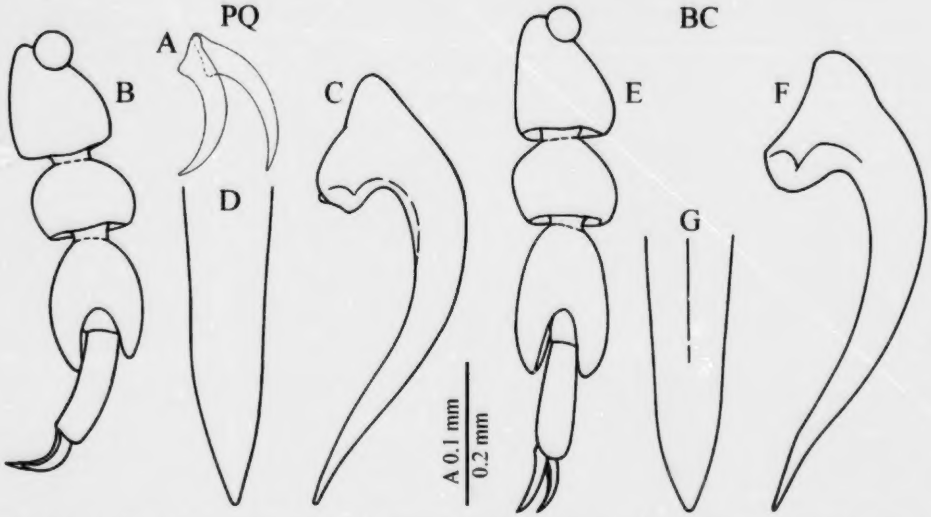


Fig. 103. *Hydroporus despectus* male. A - protarsal claws, anterior. B,E - protarsus. C,F - aedeagus, lateral. D,G - aedeagus apex, ventral. PQ - Quebec. BC - British Columbia.

Description. Length = 3.9 to 4.4 mm, width = 2.0 to 2.4 mm, length: width = 1.84 to 2.06. Similar in size and color to *H. tenebrosus* but male with narrower protarsomeres.

Head and pronotum black, elytra brown to rufopiceous. Head with frontal bar and anterior margin of clypeus rufous; ventral surface with genae black, gula red to piceous; antenna pale basally, antennomeres 2 or 3 to 11 infuscate; palpi pale basally, apical palpomere of each palp piceous. Pronotum black except anterolateral angle and lateral margin rufous. Elytron brown to piceous, palest laterally; epipleuron brown or infuscate medially. Ventral surface mainly black. Legs reddish brown to piceous; metatarsi largely brown except metatarsomere 5 infuscate (best seen in ventral aspect).

Head with moderate sized punctures, more or less evenly spaced except crowded in frontal impressions. Pronotum medially with intermixed very small and larger setiferous punctures, setiferous punctures denser and predominating along margins especially basally and laterally. Elytron coarsely punctate, punctures separated by one and one half to two times their own diameters, each bearing a conspicuous brown setae about twice as long as distance between punctures; epipleuron distinctly punctate. Metasternum laterally with coarse, separated punctures; metacoxal plate and sterna 1 and 2 with punctures slightly smaller, more evenly distributed. Sternum 6 with punctures small and deep, sparse.

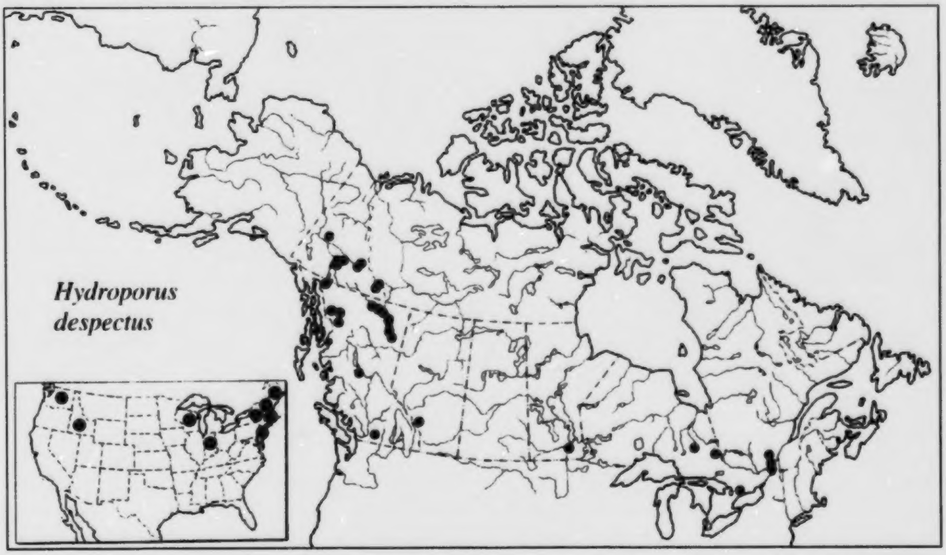
Pronotum with lateral bead of moderate width, relatively strongly raised and sharply defined; posterolateral angle right angled to slightly obtuse, base adjacent to angle straight or faintly emarginate; lateral margin straight in lateral aspect. Elytron with lateral margin ascendant in lateral aspect, epipleuron not visible at shoulder. Prosternum with file evident, prominence obtuse, process narrow, pointed apically. Metacoxal processes conjointly with hind margin truncate or very faintly and broadly produced. Protibia with a single longitudinal row of punctures on anterior face.

Male width of protibia = 0.18 mm, protarsal ratio = 0.79: 0.78: 0.73 (Fig. 103B, E); protarsomere 1 with two and protarsomere 2 with one pair of adhesive setae on ventral surface; anterior protarsal claw (Fig. 103A) slightly shorter and broader than posterior claw, evenly arcuate. Aedeagus (Fig. 103C, D, F, G) elongate, length = 0.45 to 0.54 mm; in lateral aspect flattened and slightly sinuate apically, apex without a small knob; in dorsal aspect sides parallel and not constricted medially.

Comments. As presently understood, this species has a peculiar range with two populations: one west of the Rocky Mountains in southern Canada and adjacent United States and the other in the northeastern United States. Although unusual, there is no other evidence to indicate more than one species is involved. In the east, the species appears to be uncommon. It is more common in the west but because confusion has existed about its recognition and limits, its distribution is not well known.

Ecology. Western specimens have been collected from amongst flooded grasses and sedges of beaver dams in mountain meadows in the Okanagon region of British Columbia.

Distribution. Map 120. The known range includes the northeastern United States and western North America.



Map 120. *Hydroporus despectus* Sharp. Canadian and Alaskan collection localities and United States state records.

52. *Hydroporus pervicinus* Fall 1923

Fig. 104A – D

Hydroporus pervicinus Fall 1923: 84. Holotype, male in MCZC, labelled: Lake Tahoe, Cal., Jul 17 21 97/ / TYPE pervicinus/ M.C.Z. Type 23943 (red label)/ H.C. FALL COLLECTION/ HOLOTYPE, Hydroporus pervicinus Fall, 1923 (red label). Type examined.

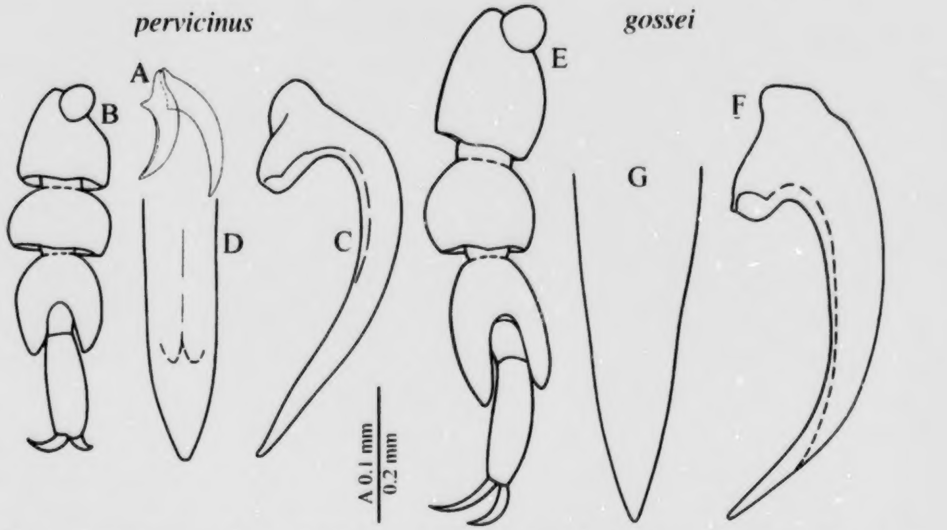


Fig. 104. *Hydroporus* male. A – C - *H. pervicinus*. A - protarsal claws, anterior. B - protarsus. C - aedeagus, lateral. D - aedeagus apex, ventral. E – F - *H. gossei*. E - protarsus, dorsal. F - aedeagus, lateral. G - aedeagus apex, ventral.

Selected References. Hatch 1953: 207; Leech and Chandler 1956: 318; Anderson 1962: 63; Gordon and Post 1965: 17; Larson 1975: 311.

Description. Length = 3.8 to 4.2 mm, width = 1.9 to 2.1 mm, length: width = 1.94 to 2.06. Body rather elongate-oval but pronotum more strongly curved laterally and broader anteriorly than in *H. tenebrosus*, widest slightly behind middle; lateral outline more or less continuous in dorsal aspect.

Color rufopiceous to black. Head dorsally piceous to black except frontal bar reddish, anterior margin dark reddish to piceous; head ventrally with genae piceous, gula paler. Antennomeres 2 or 3 to 11 infuscate; palpi pale with apical palpomere of each palpus infuscate. Pronotum black with lateral margins narrowly piceous. Elytron piceous medially, laterally dark reddish to piceous; epipleuron piceous. Ventral surface mainly piceous to black. Legs reddish with tibia and tarsi largely infuscate.

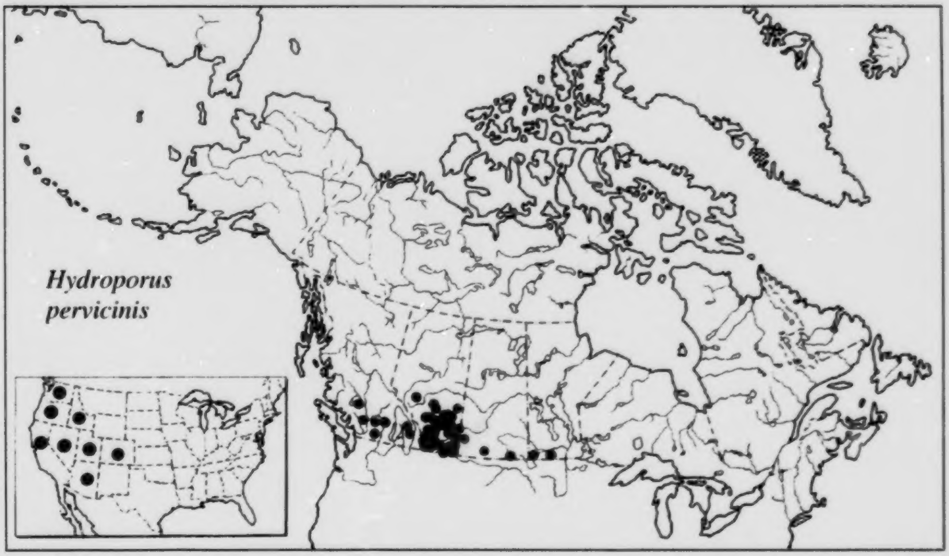
Head with punctation of frons relatively coarse, on average coarser than on similar sized species. Pronotum medially with punctures small and sparse with dual punctation less distinct than in *H. despectus* or *H. tenebrosus*; punctures coarser and denser towards margins, especially posterior margin. Elytron with punctures separated by one to one and one half times their own diameters; each bearing a brown seta; epipleuron distinctly punctate. Metasternal wing and sterna 1 and 2 coarsely punctate; metacoxal plate with punctures on most specimens slightly smaller and more widely spaced; sternum 6 with punctures small. Dorsal surface with evident microreticulation, meshes open and body somewhat shiny; sculpture similar on both sexes.

Pronotum with lateral bead distinct, of moderate width; posterolateral angle right angled to slightly acute, base slightly to distinctly sinuate laterally; lateral margin straight in lateral aspect. Elytron slightly ascendant, epipleuron disappearing well posterior to shoulder in lateral aspect. Prosternum with file evident; prominence low and obtusely angulate in lateral aspect. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal process conjointly with hind margin truncate.

Male protarsomeres 1 and 2 subequal in width, 3 slightly narrower (Fig. 104B); protibia width = 0.19, protarsal ratio = 0.78: 0.77: 0.69; anterior protarsal claw (Fig. 104A) about two thirds length of posterior, broader and more strongly arcuate. Aedeagus (Fig. 104C, D) narrow in lateral aspect, with a very slight apical sinuation; in dorsal aspect subparallel medially, bluntly pointed apically.

Ecology. This species occurs along the margins of small, often temporary, grassland ponds. This is one of the few grassland species of *Hydroporus* and in Alberta shows a higher level of habitat association with species of *Hygrotus* than with other species of *Hydroporus* (Larson 1985).

Distribution. Map 121. The range extends from the southern prairie provinces and southern British Columbia, to California and Arizona.



Map 121. *Hydroporus pervicinus* Fall. Canadian and Alaskan collection localities and United States state records.

53. *Hydroporus hirsutus* Gordon 1981

Hydroporus hirsutus Gordon 1981: 117. Holotype, male in CASC, labelled: Mt. Goethe, Fresno Co., CALIF., 9.VII.1952, Peter Raven. Type examined.

Description. Length = 3.6 to 4.0 mm, width = 1.8 to 1.9 mm, length: width = 2.02 (measurements based on holotype and values given by Gordon 1981). Body elongate, nearly parallel sided, maximum width at middle of elytra and rounded posteriorly; lateral outline continuous in dorsal aspect.

Color reddish brown with head and pronotum piceous. Head dorsally piceous with frontal bar and anterior margin of clypeus, reddish; head ventrally piceous, gula paler, reddish to rufopiceous; antenna with antennomeres 1 to 4 pale, at least ventrally, outer antennomeres largely piceous; palpi reddish basally, apical palpomere of each palpus almost entirely piceous. Pronotum piceous medially, becoming rufopiceous laterally. Elytron brown, epipleuron reddish. Ventral surface of body mainly black. Legs reddish, femora with basal two thirds brown to piceous.

Head medially coarsely punctate, punctures smaller and sparser towards margins. Pronotum medially with moderately coarse punctures separated by about twice their diameters; laterally and basally punctures somewhat denser but clearly separate. Elytron with punctures coarse, larger than those on base of pronotum and giving elytron a dimpled appearance, separated by a distance about equal to their diameters; each puncture bearing a fine pale setae about one and one half as long as distance between punctures; epipleuron with distinct punctures each bearing a seta slightly longer than distance between punctures. Metasternal wing with coarse, irregular punctation, punctures separated on average by more than their diameter; metacoxal plate with punctures slightly smaller, shallower and much less conspicuous, somewhat obscured by shallow transverse rugae and coarse microreticulation; sterna 1 and 2 with punctures deeper and more conspicuous than those of metacoxal plate; sternum 6 with punctures small but deep, sparse anteriorly, densest but separate medioapically. Dorsal surface with evident microreticulation; male shiny, female less shiny due to more deeply impressed reticulation but surface not matte.

Pronotum with lateral bead of moderate width, sharply delimited throughout its length; basal margin shallowly sinuate each side of posteromedial lobe, posterolateral angle slightly obtuse. Elytron in lateral aspect with lateral margin ascendant to humeral angle. Prosternal file evident; prominence evident but obtuse in lateral aspect; blade tectiform in cross section, pointed apically. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly with hind margin slightly angulate medially.

Male protibia width = 0.17 mm, protarsal ratio = 0.72: 0.77: 0.69; protarsomere 1 with two and protarsomere 2 with one pair of small scales on ventral surface; protarsomere 3 elongate oval; anterior protarsal claw slightly shorter than posterior and more arcuate basally, posterior claw half length of apical protarsomere. Aedeagus in dorsal aspect subparallel medially, gradually narrowing to a blunt point in apical third; in lateral aspect apex slightly sinuate.

Comments. The holotype does not agree very well with Gordon's (1981) description. It is notably smaller and the aedeagus (relaxed in hot water and drawn in glycerine) is not constricted medially. The species has no distinctive characters other than the conspicuous pale pubescence and somewhat obscure punctation of the metacoxal plate. The species is extremely close to *H. pervicinus*, even to the extent of having a slightly modified anterior protarsal claw on the male. The aedeagus and male protarsomeres are indistinguishable.

Ecology. Not recorded.

Distribution. This species is known only from the type locality, Mt. Goethe, Fresno Co., California.

54. *Hydroporus rectus* Fall 1923

Fig. 105

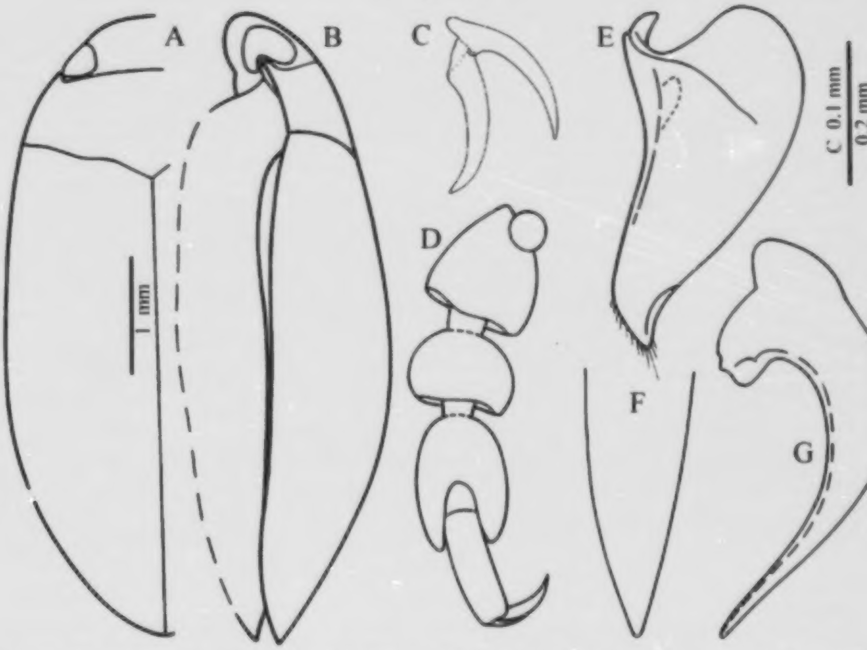


Fig. 105. *Hydroporus rectus* male. A - left body outline, dorsal. B - body outline, lateral. C - protarsal claws, anterior. D - protarsus. E - paramere. F - aedeagus apex, ventral. G - aedeagus, lateral.

Hydroporus rectus Fall 1923: 79. Holotype - male in MCZC labelled: Hermit Lake, 3700 ft. N.H./ / M.C.Z. Type 23950 (red label)/ H.C. FALL COLLECTION/ HOLOTYPE, Hydroporus rectus Fall, 1923. Type examined.

Selected References. Fall 1923: 79; Larson 1975: 309 – 310; Hilsenhoff 1995: 13.

Description. Length = 4.2 to 4.7 mm, width = 2.0 to 2.3 mm, length: width = 2.00 to 2.11. Body (Fig. 105A, B) elongate, sides subparallel or gradually broadening posteriorly, widest well behind middle and narrowly rounded posteriorly; lateral outline continuous in dorsal aspect.

Color piceous to black. Head dorsally black except clypeus, a triangular area on anteromedial portion of frons, and frontal bar, reddish (some specimens with head more broadly reddish and dark markings restricted to a spot mesad of each eye); head ventrally entirely pale; antenna with antennomeres 1 to 2 or 3 yellow, more distal antennomeres infuscate at least apically; maxillary palpus yellow with terminal palpomere infuscate apically, labial palpus entirely yellow without apical infuscation. Pronotum black except anterolateral angle and lateral margin, reddish to piceous. Elytron dark reddish to piceous medially, paler laterally; epipleuron reddish to piceous. Ventral surface black except sterna 3 to 6 reddish apically and laterally. Legs reddish with femora and tibia of most specimens slightly darkened.

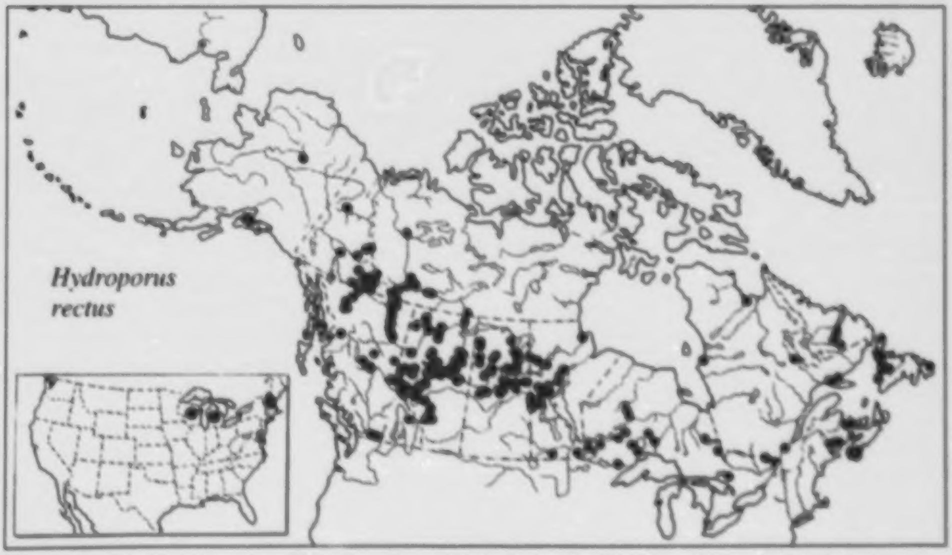
Head rather coarsely punctate medially, punctures smaller and sparser laterally. Pronotum with coarse setiferous punctures laterally, medially on disc punctures finer and sparser with intermixed setiferous and nonsetiferous punctures. Elytron more or less evenly, coarsely punctate, punctures separated by about twice their diameters, each puncture bearing a slender, pale seta slightly longer than distance between punctures. Metacoxal plate with punctures broad but shallow, more or less evenly distributed, less dense and shallower than those on metasternal wing or lateral portions of sterna 1 and 2; sternum 6 with small, sparse punctures. Dorsal surface with reticulate microsculpture, similar on both sexes or lines somewhat more deeply impressed on female.

Pronotum with lateral bead well delimited and of more or less even width throughout its length; posterolateral angle about right-angled, base more or less straight each side of medial lobe or faintly emarginate near lateral angle; lateral margin in lateral aspect straight, proepipleuron narrowly visible anteriorly. Elytron with lateral margin slightly ascendant in lateral aspect; epipleuron disappearing posterior to humeral angle. Prosternum with file well developed, prominence more or less obsolete and very broadly obtuse in lateral aspect; blade relatively broad and broadly tectiform. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly with hind margin truncate or broadly and slightly angulate.

Male protibia width = 0.20 mm, protarsal ratio = 0.74 : 0.78 : 0.63 (Fig. 105D); tarsomeres 1 and 2 with two and one pairs of oval scales beneath, respectively; protarsal claws (Fig. 105C) little modified, anterior claw slightly broader and, on some specimens, slightly shorter than posterior. Aedeagus (Fig. 105F, G) in lateral aspect broad basally, strongly narrowed about middle to ligate apex, apical portion straight or slightly sinuate in some specimens.

Ecology. This is one of the most characteristic species of peatlands, especially bogs, within the boreal zone of North America (Larson 1985, 1987*a*). Specimens occur in cold water among sphagnum mosses or mats of emergent *Carex* and moss.

Distribution. Map 122. The range extends from Newfoundland to Alaska.



Map 122. *Hydroporus rectus* Fall. Canadian and Alaskan collection localities and United States state records.

55. *Hydroporus gossei* Larson and Roughley, new species
Fig. 104E – G

HOLOTYPE - male labelled: Nfld., Terra Nova National Park, Southwest Brook, beaver pond, June 15, 1996, D. and M. Larson. Deposited in CNC.

ALLOTYPE - female, same collection data. as holotype.

PARATYPES - NEWFOUNDLAND - same collection data as holotype (12♂♂,12♀♀); 29 km e Plum Point, lot 6, July 3-5, 1980, Brennan and Larson (9♂♂,6♀♀); pond nr Blue Cove, June 30, 1980, Brennan and Larson (1♂); 10 km w Conche, July 4, 1980, Brennan and Larson (1♀); beaver pond 10 km s South Pond, June 27, 1980, Brennan and Larson (1♂); Northern Pen., 3 Mile Pond Pk., June 30, 1980, Brennan and Larson (1♀); Watson's Pond 8 mi s Corner Brook, June 18, 1979, Larson and Swales (1♀); Milan Arm, Pistolet Bay, July 2, 1980, Brennan and Larson (1♀, 1♂); Indian R. nr Hwy 410 jct., Aug. 9, 1982, D. Larson (1♂); NEW BRUNSWICK - St. Georges, Oct. 4, 1984, D. Larson. Paratypes deposited in CARR, CASC, CNC, MCZC, MUN, JBWM, USNM.

Additional specimens examined from: Ontario - Windigo Lake Road, 162 km NW Otoskwin River, Lot 1, 25.VII, 1992, B.F. and J.L. Carr (1♀, CARR); Quebec - Parc du Mont Tremblant, 13-IV-1958, A. Robert (3♂♂, 1♀, University of Montreal); Maine - Mt. Katahdin, 4636 feet, June 29, 1968, D. R. Oliver (1♀, CNC); Michigan - Marquette (4♂♂, 4♀♀, USNM); New York - Cranberry Lake, June 15, 1922, M. H. Hatch (1♂, CNC).

Derivation of name. This species is named in honour of Philip Henry Gosse, a naturalist and illustrator of Newfoundland insects between 1832 and 1835. Gosse's excellent entomological illustrations are in a manuscript entitled Entomologia Terrae Novae, deposited in the National Museum, Ottawa (Bruton 1930; Morris 1980).

Description. Length = 4.3 to 5.0 mm, width = 2.2 to 2.6 mm, length: width = 1.93 to 2.02. Moderately large, similar in size to *H. rectus* but of different habitus, body slightly more ovate and not so parallel sided, widest near middle; lateral outline continuous in dorsal aspect.

Color mainly piceous to black. Head dorsally piceous to black except frontal bar and anterior margin of clypeus reddish; head ventrally with genae piceous, gula reddish; antenna yellow basally, antennomeres 3 to 11 infuscate; palpi yellow with apical palpomere of each palpus infuscate apically. Pronotum black, faintly piceous laterally. Elytron piceous, rufescent apically and laterally, especially posterior to shoulder; epipleuron dark reddish to piceous. Ventral surface mainly black, sterna 3 to 6 laterally with reddish spots. Legs reddish with femora slightly infuscate basally.

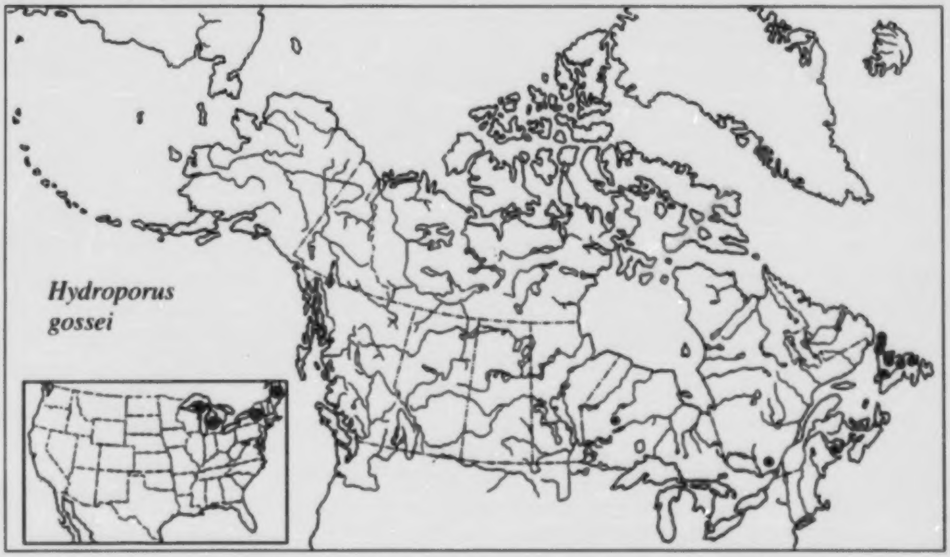
Head with intermixed fine and coarse punctures. Pronotum sparsely punctate medially with intermixed coarse setiferous punctures and fine punctures, laterally and near margins punctures of varied size, generally coarse, separated by their own diameters or less or even confluent. Elytron coarsely punctate, punctures subequal in size to those of base of pronotum, separated by about their own diameters; with brown setae one and one half times longer than distance between punctures; epipleuron with sparse conspicuous punctures. Metasternal wing, metacoxal plate and sterna 3 to 6 with punctures coarse, those on metasternal wing deepest and most irregular; metacoxal plate with punctures of similar size over entire surface, separated by their own diameters or less; sternum 6 with sparse small punctures. Body surface microreticulate but lightly so on disc of pronotum which is relatively shiny; reticulation similar on both sexes or female with lines slightly deeper.

Pronotum with lateral bead well defined and of moderate width; posterolateral angle slightly produced, right angled to slightly acute; base slightly emarginate mesad of posterolateral angle; lateral margin straight in lateral aspect except slightly reflexed upwards on anterolateral angle and exposed proepipleuron obliquely flattened laterally. Elytron slightly and evenly ascendant to humeral angle; epipleuron disappearing posterior to humeral angle. Prosternum with file well developed with strong transverse ridges, prominence obsolete or low and very broadly obtuse in lateral aspect; process narrowly oval, bluntly pointed. Protibia with anterior face bearing a single longitudinal row of punctures. Metacoxal processes conjointly truncate.

Male protibia width = 0.20 mm, protarsal ratio = 0.79: 0.77: 0.67 (Fig. 104E); protarsomere 1 with about four pairs and protarsomere 2 with two pairs of adhesive scales on ventral surface; protarsal claws subequal in length, anterior slightly broader than posterior. Aedeagus (Fig. 104F, G) in lateral aspect more or less straight in apical third; in dorsal aspect broad basally, evenly narrowed to sharply pointed apex.

Comments. This large, distinctive species has been overlooked because it has generally been confused with *H. rectus*. However, specimens of *H. gossei* can be easily recognized by the infuscate apical palpomere of the labial palp, more ovate form and coarser punctation.

Ecology. In Newfoundland, specimens have been collected from among flooded grasses and emergent *Carex* along the margins of beaver ponds and roadside ponds. They occurred on peaty substrates and were near boggy areas but were not in sphagnum. Beetles were collected from areas exposed to the sun as well as from shorelines shaded by overhanging alder.



Map 123. ***Hydroporus gossei*** **Larson and Roughley. Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 123. This species has a rather wide distribution in northeastern North America, with records extending from Newfoundland to Michigan and south to Maine and New York.

Genus *Hydrocolus* Roughley and Larson, new genus

Figs. 23E; 106; 107

Hydroporus oblitus-group sensu Fall 1923: 47 – 54.

Type species - *Hydroporus paugus* Fall 1923, by present designation.

Etymology. From the Greek, *hydor, hydatos*, for water with the Latin suffix *-cola*, meaning inhabitant of, or, living among.

Diagnosis. Size relatively small, length = 2.6 to 4.7 mm. Body shape elongate oval to subparallel in dorsal aspect; distinctly flattened to somewhat depressed dorsoventrally in lateral aspect.

Color of dorsal surface yellowish or reddish brown to rufopiceous, elytra not bicolored; ventral surface mainly black but sterna 3 to 6 with conspicuous reddish lateral spots. Dorsal surface conspicuously punctate, setae sparse and inconspicuous. Microreticulation present but variously developed, most males relatively shiny, females with microsculpture more impressed and duller; female sculpture dimorphic in some species with some females similar to male, other females with dense punctuation and microsculpture.

Head broad; antenna not modified; clypeus with anterior margin unmodified; eye relatively small but size various [index of eye width given as ratio of width of head across eye (WH1): width of head between eyes (WH2)] . Pronotum, in dorsal aspect, with sides rounded laterally and continuous in outline with elytra, broader at base than elytra, or narrowed posteriorly and somewhat narrower than elytra basally; lateral bead broad to very broad; disc without sublateral crease or lines. Apex of scutellum minutely visible at base of elytra. Elytron, in lateral aspect, with lateral margin strongly ascendant towards humeral angle, epipleuron visible to or almost to shoulder; without a carina crossing epipleuron at humeral angle; ventral surface with submarginal ridge widened apically but not forming a projecting ligula; without a subapical lateral tooth. Prosternum declivitous but file and prominence weakly expressed, obtuse to obsolete, file with a few transverse rugae or obsolete; prosternal process elongate-oval, bluntly pointed apically, widely margined laterally, evenly convex medially and without a well developed medial ridge. Metasternum not sulcate medially. Metacoxal process (Fig. 23E, 106A) with hind margin broadly emarginate each side of medial line, apex produced along medial line; lateral lobe covering base of metatrochanter. Metatrochanter of moderate length, metafemur separated from metacoxal lobe. Metafemur and metatibia sparsely punctate.

Male protibia with a basoventral emargination (Fig. 106B); protibia greatly expanded apically, width at apex 1.5 times width of protarsomere 1. Male protarsus slightly dilated, protarsomere 1 with 4 or 5 pairs of scales on ventral surface. Aedeagus various, in most specimens symmetrical in dorsal aspect with apex pointed but *H. deflatus* with aedeagus asymmetrical and complexly flanged; parameres symmetrical or not (*H. deflatus*).

Comments. This new genus represents the *Hydroporus oblitus*-group of Fall (1923). A number of features suggest that this group represents a new genus. Adult male specimens have a strongly notched protibia, the overall shape of specimens is depressed and flattened and a small apical part of the scutellum is visible, in dorsal view, at high magnification. In addition, Alarie (1991) was able to provide a diagnosis of the larvae separating them from other groups of hydroporines. Of particular interest is his observation that the larval stemmata are absent from the first and second instar larvae. With these character states, the members of *Hydrocolus* are moderately well distinguished from all of the former species groups of *Hydroporus*. All of these other species groups have been treated as separate genera in recent years and in this publication.

One species which was assigned to the *oblitus*-group by (Fall 1923), *Hydroporus corvallis* Fall (1923), is transferred to the *vilis*-group (= *Sanfilippodytes* Franciscolo) based on several characters including large metatrochanter, lack of emargination of male protibia and bifid apex of the aedeagus. The majority of the members of *Hydrocolus* are restricted to North America. However, as noted by Sharp (1882: 453), one Palaearctic species, *Hydroporus picicornis* Sahlberg 1873, is very similar to species we assign to *Hydrocolus*. We also recognize this similarity and provisionally assign it to *Hydrocolus*. Adult specimens of *H. picicornis* possess the notched protibia in the male and the body shape is relatively broad and depressed. Not all features of the adults, however, are suggestive of this placement; for instance, the lateral margin of the elytron is not as strongly ascendant in lateral aspect and perhaps significantly the apex of the scutellum is not visible in dorsal aspect. Alarie (1991), referring to the larval stages, suggested that *H. picicornis* is more similar to members of *Hydroporus (s. str.)* than to other members of *Hydrocolus*. The known range of *H. picicornis* is from Siberia to Scandinavia.

Fall (1923: 47) wrote "The members of this small group form a compact body of closely related species, so uniform in nearly all points of structure that their differentiation by the student requires unusually close attention." Young (1955:64) also summarized the taxonomy of species in this genus quite effectively when he wrote "All of the members of this group...occur in springs or seepages with some notable exceptions in northern bogs and bog-like situations. The taxonomy is too confused at present to allow the clear separation of forms without very large series of specimens at hand. Nearly every isolated spring or seep seems to have a distinctive local population which could be separated from others on body shape, genitalia, punctation, coloration, or other characters." We concur. Also, another normally reliable character can be added to the list of highly variable features - size.

Most species of Dytiscidae are conservative with respect to size and most species vary only within a narrow range. Andersen and Nilssen (1983) examined intrapopulation size variation of various groups of Coleoptera. They concluded that free-living, aquatic groups, such as Dytiscidae, have a low intrapopulation size variation. They used an index, I, calculated by dividing the longest known specimen of a given species by the smallest specimen from any other population. Most species of dytiscids have a longest: shortest ratio or I = 1.1 to 1.15 although Larson (1994*a*) showed that within *Agabus*, unusually high variation in length may be related to taxonomic grouping and/or habitat characteristics. At least, three species within *Hydrocolus* (*H. deflatus*, *H. stagnalis*, and *H. persimilis*) have I = 1.20 to 1.22. Thus, a species such as *H. deflatus*, of which the majority of specimens are easily diagnosed by their large size (length greater than 4.0 mm), has such a high degree of variation (= 4.37 mm, min. = 3.81 mm, max. = 4.62 mm, I = 1.21) that there is significant overlap in total body length with at least four other species within the genus. The classification given below is rather conservative because of the kinds of taxonomic problems represented by members of this group.

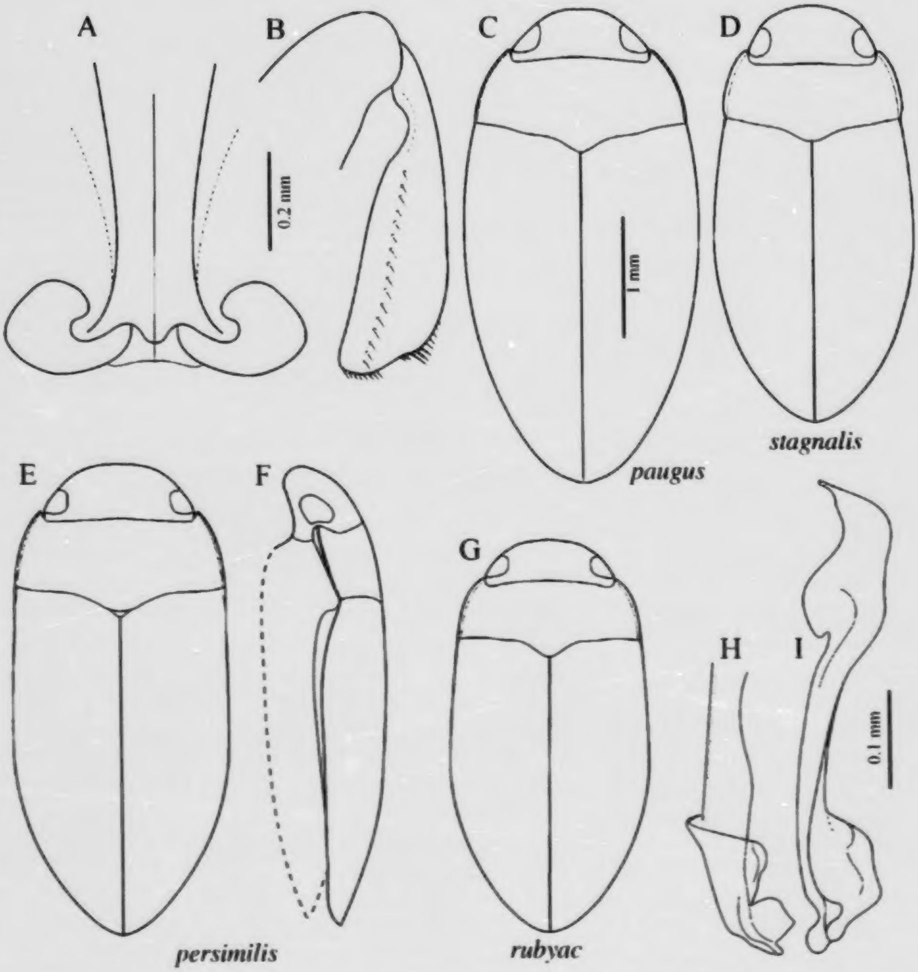

A
B
C
D
0.2 mm
1 mm
paugus
stagnalis
E
F
G
H
I
0.1 mm
persimilis
rubyac

Fig. 106. *Hydrocolus*. A - metacoxal processes. B - male protibia, anterior. C - *H. paugus* body outline, dorsal. D - *H. stagnalis* body outline, lateral. E – F - *H. persimilis* body oultine, E - dorsal, F - lateral. F - *H. rubyae* body outline, dorsal. H – I - *H. deflatus* aedeagus, H - apex, ventral, I - lateral.

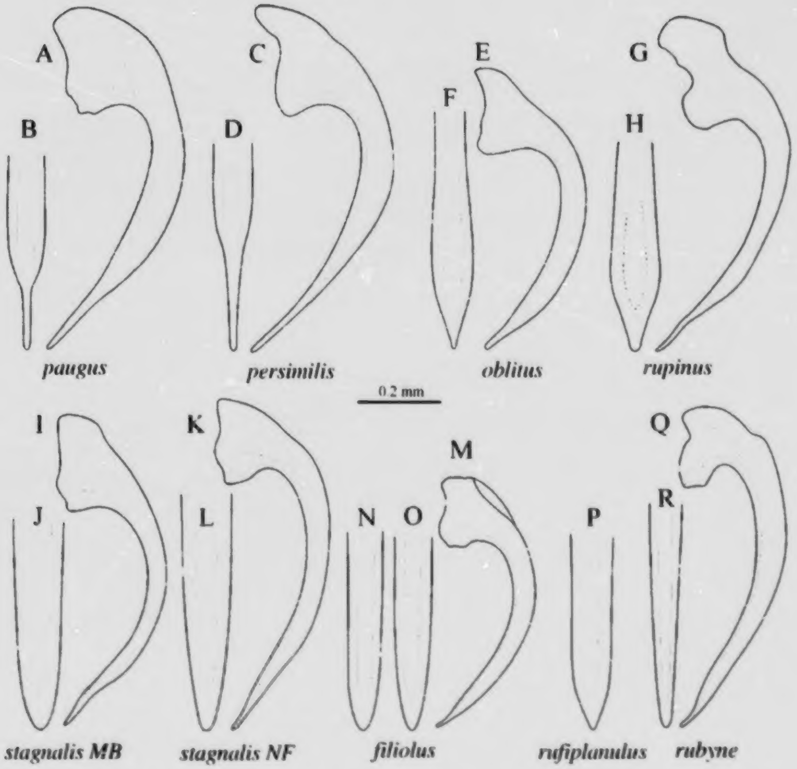


Fig. 107. *Hydrocolus*, male aedeagus. A – B - *H. paugus*, A - lateral, B - apex, dorsal, C – D - *H. persimilis*, C - -lateral, D - apex, dorsal, F – F - *H. oblitus*, E - lateral, F - apex, dorsal. G – H - *H. rupinus* G - lateral, H - apex, dorsal. I – L - *H. stagnalis* I,K - lateral, J,L - apex, dorsal. N – M - *H. filiolus*, M - lateral, N,O, - apex, dorsal. P – H - H. rufiplanulus apex, dorsal. Q – R - *H. rubyae*, Q - lateral, R - apex, dorsal.

Key to species of *Hydrocolus*

1. Palaearctic specimens; tip of scutellum not visible at apex of medial lobe of pronotum; body form distinctly convex; aedeagus, in dorsal aspect, very narrow and elongate, in lateral aspect, with apex sinuate (similar in overall shape and form to *H. rubyae*); dorsal color reddish brown; length = 2.7 to 3.2 mm; width = 1.4 to 1.5 mm; length: width = 1.94 to 2.11; width of head across eyes (WH1): width of head between eyes (WH2) = 1.40 to 1.44; Norway, Sweden, Finland to northern Siberia . . . .*H. picicornis* (Sahlberg, 1873)

1'. Nearctic specimens; tip of scutellum visible at apex of medial lobe of pronotum; body form more depressed 2

2(1). Larger specimens, length = 3.8 to 4.7 mm, most specimens greater than 4.0 mm; pronotum very broad relative to head, maximum width of pronotum: width of head across eyes = 1.54 to 1.71; aedeagus (Fig. 106H, I) asymmetrical and complexly flanged apically; Coastal Plain, New York south to Florida and west to Texas . . . . . . .1. *H. deflatus* (Fall)

2'. Smaller specimens, length = 2.6 to 4.0 mm; pronotum narrower relative to head, width pronotum (Wpr): width head across eyes (WH1) = 1.35 to 1.63, most specimens less than1.50; aedeagus symmetrical, apex simple and pointed 3

3(2). Prosternum shorter, length of prosternum anterior to procoxa subequal to greatest width of antennomere 1; elytral margins more parallel in basal third, small specimens, length less than 3.40 mm 10

3'. Prosternum longer, length of prosternum anterior to procoxa two times greatest width of antennomere 1; elytral margins converging in basal third, and/or larger specimens, length = 2.8 to 4.0 mm 4

4(3). Pronotum with lateral bead very broad, subequal in width to maximum width of an outer antennomere (Fig. 106D) 5

4'. Pronotum with lateral bead narrower, one half or less of maximum width of an outer antennomere 6

5(4). Pronotal disc with scattered coarse punctures in addition to micropunctures; some specimens with pronotum narrowed posteriorly and discontinuous with outline of elytra at base; pronotum with lateral bead distinct, narrow elongate area parallel to and interior to bead impressed; more boreal species, Newfoundland to Alberta and south to Rhode Island, Illinois and Wisconsin ....9. *H. stagnalis* (G. & H.)

5'. Pronotal disc with micropunctures only; pronotum not narrowed posteriorly and not narrower than elytra at base; pronotum with lateral bead less distinct, not impressed interior to bead; more southern species, Pennsylvania to Indiana south to Arkansas and Missouri ....5. *H. oblitoides*, n.sp. (in part)

6(4). Body form, in dorsal aspect, broadly rounded in outline and distinctly attenuate posteriorly; metafemur and metatibia brown and strongly contrasting with yellowish red metatrochanter; elytron with punctures coarse, dense and uniform, punctures separated by 1 to 2 times their diameter; dorsal color piceous except head and pronotal margins rufous; Georgia ....10. *H. rupinus* n.sp.

6' Body form, in dorsal aspect, more parallel in outline and more rounded posteriorly; metafemur and metatibia various in color but not strongly contrasting with metatrochanter; elytron with punctures fine or coarse but less dense and somewhat to distinctly irregular, separated by 2 or more times their diameter; dorsal color yellowish to reddish brown; eastern United States and Canada 7

7(6). Aedeagus in ventral aspect constricted subapically, apex slender and parallel sided (Fig. 107B, D) or at least sharply pointed (Fig. 107F); length = 2.8 to 4.0 mm 8

7'. Aedeagus not distinctly constricted subapically, evenly narrowed to apex; length = 2.6 to 3.7 mm; Pennsylvania to Indiana south to Arkansas and Missouri ....5. *H. oblitoides*, n.sp. (in part)

8(7). Eyes relatively larger and less widely separated, WH1: WH2 , of most specimens, greater than 1.50; elytron with punctures smaller, more dense and more uniform, head relatively more finely and sparsely punctate; aedeagus with subapical constriction abrupt (Fig. 107B) 9

8'. Eyes relatively smaller and more widely separated, WH1: WH2 = 1.36 to 1.50; elytron with punctures coarse, sparse and more irregular, head relatively densely punctate; aedeagus with subapical constriction more gradual (Fig. 107D); Newfoundland to Quebec and Wisconsin, south to Tennessee and Kentucky . . . . .3. *H. persimilis* (Crotch)

9(8). Smaller specimens, length = 2.84 to 3.44 mm; eyes larger, WH1: WH2 = 1.46 to 1.69; distribution more southern and along the Coastal Plain from New York south to Florida and west to Texas . . . .4. *H. oblitus* (Aubé)

9'. Longer specimens, length = 3.45 to 4.00 mm; eyes smaller, WH1: WH2 = 1.50 to 1.65; distribution more northern and more inland from Alaska to Newfoundland south to Massachusetts, Iowa, Colorado and Utah . . . . .2. *H. paugus* (Fall)

10(3). Body form, in lateral aspect, and particularly pronotum more convex; prosternal prominence absent, file obsolete; elytral with meshes of sculpture larger than those of pronotal disc; aedeagus slender, in ventral aspect, evenly tapering to shortly rounded apex; Yukon to Newfoundland south to Wisconsin . . . . .6. *H. rubyae* (Larson)

10'. Body form, in lateral aspect, and particularly pronotum more depressed; prosternal prominence low and rounded but more distinct, file present; elytral meshes subequal to those of pronotal disc; aedeagus broader in ventral aspect, subparallel with apical constriction terminal 11

11(10). Eyes smaller, WH1: WH2 = 1.41 to 1.46; color uniformly reddish dorsally; elytra coarsely punctate; prosternal process with blade broad and with margins wide and well differentiated; last abdominal sternum distinctly if minutely punctate medially; pronotum broad and discontinuous in outline with curvature of elytra in dorsal aspect; aedeagus more sharply pointed apically (Fig. 107P); Quebec and Maine south to Virginia .8. *H. rufiplanulus* (Fall)

11'. Eyes larger, WH1: WH2 = 1.52; color yellowish brown; elytra with punctation not conspicuously coarse; prosternal process with blade elongate oval and with margins narrower and less well differentiated; last abdominal sternum impunctate or at most obscurely punctate; pronotum less strongly rounded laterally and more or less continuous in outline with elytra in dorsal aspect; aedeagus with apex more rounded (Fig. 107M – O); Michigan to New Hampshire south to Florida . . . . 7. *H. filiolus* (Fall)

1. *Hydrocolus deflatus* (Fall 1923), new combination

Fig. 106H, I

Hydroporus deflatus Fall 1923: 44. Type locality - Gencarlyn, Alexandria Co., Virginia. Holotype - male labelled: Glencarlyn [*sic*], Alexandria Co., Virginia, VI-24-13, E. Shoemaker (specimen in the Fall collection, MCZC, specimen examined). Also examined, a second specimen in Fall collection labelled: Glencarlin, Alex. Co., Va. VI-24, 1913/ E. Shoemaker collector/ Hydroporus deflatus Fall Ms/ Shoemaker Collection 1956. This specimen is part of the type series.

Selected References. Fall 1923: 44; Young 1954: (as *Hydroporus ?ruficeps*); Epler 1996: 3.57.

Description. Large, length = 3.8 to 4.7 mm; width = 2.0 to 2.3 mm; length: width = 1.85 to 2.04. Body in dorsal aspect very broad, broadly oval in outline, lateral margin continuous in outline between pronotum and elytron, point of maximum width anterior to middle on most specimens.

Color of dorsal surface yellowish to piceous; anterior margin of head, broad lateral area of pronotum, elytron with humeral, lateral and posterior margins as well as sutural margin on some specimens paler, yellowish, gradually darkening medially. Some specimens sub-irrorate with elytral punctures appearing darker. Pro-, meso- and metasternum of most specimens increasingly dark brown to piceous, abdomen with lateral area paler, yellow to orange. Antennae, palpi and legs yellow to orange.

Head finely and sparsely punctate, punctures much larger than those of disc of pronotum. Pronotum with punctures very small on disc, coarser towards margins except posterolaterally punctures crowded, nearly confluent and forming ill-defined strigae on some specimens. Elytron moderately punctate; punctures somewhat sparse and irregular, separated by 3 to 5 times their diameter; individual punctures very distinct, appearing crater-like due to sharp margins; epipleuron moderately, sparsely punctate. Metasternum laterally and disc of metacoxal plate coarsely and sparsely punctate; latter with punctures separated by 3 times their diameter. Abdomen with sternum 1 and 2 coarsely, sparsely punctate laterally; sterna 3 to 5 shallowly and sparsely punctate; sternum 6 not punctate medially, punctures fine and sparse laterally and posteriorly. Dorsal surface of male specimens shiny but entire surface finely reticulate, elytral meshes noticeably larger than those of pronotal disc; female specimens with sculpture more strongly impressed but very dull, shagreened, female specimens not seen.

Width of head across eyes (WH1): width of head between eyes (WH2) = 1.45 to 1.56. Pronotum much broader than head, width of pronotum: width of head across eyes = 1.54 to 1.71. Body in lateral aspect strongly depressed, metasternum distinctly impressed above level of prosternal process. Metacoxal lines diverging only slightly anteriorly. Pronotum uniformly curved laterally, with point of maximum width at hind angles; lateral margins broadly explanate laterally, a triangular posterolateral area (corresponding with area of smaller, denser punctures) distinctly depressed, depression extended medially in some specimens; lateral bead very wide, subequal in width to width of an apical antennomere. Elytra oval, widest at base, some specimens with humeral margin sinuate in dorsal aspect, and narrower slightly posterior to pronotal-elytral juncture making pronotum appear more prominent. Prosternum anteriorly with a raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of prosternal process; prosternal process with file distinct, prosternal prominence low and rounded, blade with a low, rather flat medial convexity, broadly margined basally, not margined and broadly rounded apically.

Male protibia (Fig. 106B) ventrally deeply emarginate in basal quarter, margin proximad to emargination sinuate, margin distad to emargination broadly rounded to apex; protibia dorsally distinctly bent at about 45 degree angle posterior to level of emargination. Protarsomere 1 to 3 dilated; protarsal claws unmodified, anterior claw slightly shorter than posterior claw; mesotarsomeres 1 to 3 narrower but wider than those of female. Aedeagus (Fig. 106H, I) large, in lateral aspect with shaft straight or inversely curved, apex complexly differentiated; in dorsal aspect asymmetrical with apex bearing scoop-like flanges; dorsal surface broadly open. Parameres asymmetrical, left paramere broader than right apically, with its apex partly encompassing apex of aedeagus.

Female with protibia with dorsal margin linear; ventral margin very shallowly but distinctly sinuate basally. Pro- and mesotarsomeres 1 to 3 narrow.

Comments. The male genitalia is unlike that of any other species of the genus. However, in other features this species corresponds to the other species of the genus so that its inclusion in *Hydrocolus* appears to be its best placement.

Ecology. Very little is known about the habitat of this species. Two separate series from York Co., Pennsylvania, were taken from spring seepage in June and July. The most extensive series was taken from a small pool in a Maryland cypress swamp in October. This pool was formed at the base of a blown-down tree in the middle of a densely shaded, bald cypress forest. The pool was filled with leaves but it was without emergent vascular plants. Occasional specimens have been taken in flight intercept traps [mid-May to mid-August in Mississippi and mid-August in Louisiana]; specimens were collected at a black light trap in a wet woodland swamp in northern Ohio in mid-June.

Distribution. The distribution may be described as the coastal plain of the eastern United States from Long Island, New York, south to Florida and west to eastern Oklahoma and Texas, but like many coastal plain species the range extends northward up the Mississippi River basin to southern Illinois. As mentioned by Fall (1923), specimens of this species are uncommon in collections.

2. *Hydrocolus paugus* (Fall 1923), new combination

Figs. 106C; 107A, B

Hydroporus paugus Fall 1923: 50. Type locality - Tyngsboro, Massachusetts. Holotype, male in MCZC labelled: Tyngsboro Ms, 8/31/00. MCZC Type 23942. Type examined.

Selected References. Brown 1932*b*: 201; Hatch 1953: 204; Larson 1975: 289 – 290; Hilsenhoff 1995: 16.

Description. Moderately large, length = 3.4 to 4.0 mm; width = 1.7 to 2.0 mm; length: width = 1.94 to 2.18. Body, in dorsal aspect (Fig. 106C), elongate-oval in outline, more rounded laterally than in related species and with maximum width near middle and distinctly wider at this point than pronotum across base.

Color of dorsal surface pale reddish yellow to piceous, head anteriorly and lateral margins of pronotum and elytra paler. Ventral surface largely dark brown to black with proepisternum, hind margins of sterna 3 to 6, and a lateral spot on each of sterna 3 to 5, pale brown to reddish. Antenna and palpi pale basally, infuscate apically. Legs pale brown.

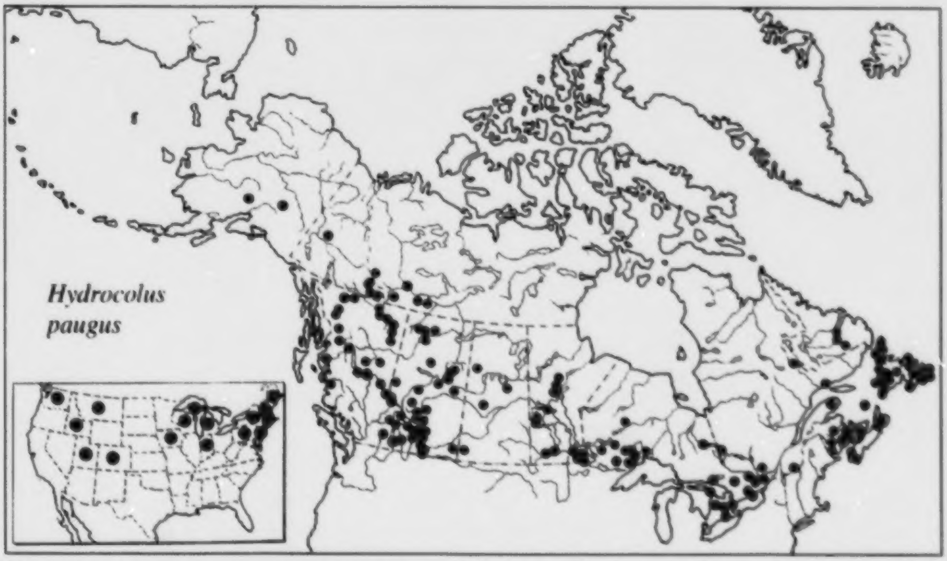
Head finely and sparsely punctate, punctures about equal in size to those on disc of pronotum. Pronotum with punctures small on disc, coarser and larger toward margins, posterolaterally punctures crowded and forming ill-defined strigae on some specimens.

Elytron with punctures small and dense, separated by about 1 to 2 times their diameter; epipleuron moderately, sparsely punctate. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 2 to 3 times their diameter. Abdomen with sternum 1 and 2 coarsely and sparsely punctate laterally; sterna 3 to 5 finely punctate; sternum 6 finely and sparsely punctate medially, punctures larger and more dense laterally and posteriorly. Dorsal surface of male shiny but finely microreticulate, elytral meshes larger than those of pronotal disc; female with sculpture more strongly impressed, some specimens with surface very dull and shagreened.

Eyes relatively large, WH1: WH2 = 1.50 to 1.64. Pronotum in dorsal aspect with lateral margin uniformly curved, with point of maximum width at or near hind angles; pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.43 to 1.52; lateral margins not explanate laterally; lateral bead distinct, about half width of apical antennomeres. Elytra elongate oval, widest in basal third, some specimens with humeral margin sinuate, in dorsal aspect, and narrower slightly posterior to pronotal-elytral juncture making pronotum appear more prominent. Body, in lateral aspect, depressed, metasternum not distinctly impressed above level of prosternal process. Metacoxal lines slightly diverging anteriorly. Prosternum anteriorly with a raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of posternal process; prosternal process with file weak or absent, prosternal prominence low and rounded, blade broad and long, with a low, broad medial convexity, broadly margined basally, margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus (Fig. 107A, B) in ventral aspect abruptly constricted in apical quarter to third, apex narrow and needle-like; parameres symmetrical.

Ecology. These beetles occur among moss or dense emergent vegetation and debris along the margins of small pools, ponds, and springs. They occur in peatlands as well as in sites where the water surface is shaded and the water is cool. Hilsenhoff (1995) found that in the fall most specimens occurred in streams whereas in the spring most were in shallow ponds and marshes. He concluded that adults overwinter in streams or deeper



Map 124. *Hydrocolus paugus* (Fall). Canadian and Alaskan collection localities and United States state records.

ponds and invade shallow, lentic sites to breed. However, in Canada we have seen no evidence of movement to nonfrozen sites for overwintering. Some specimens among a long series of specimens collected in late July near Tobermory, and Cordova Mines, Ontario and in early to mid-July on the E.S. George Reserve in Livingston Co., MI are teneral. Larson (1975) records teneral specimens collected in the Province of Alberta from August 5 to 27.

Distribution. Map 124. This Nearctic species is primarily boreal in distribution. The range extends from Newfoundland to Alaska and British Columbia and south to the New England States, Iowa, Colorado and Utah.

3. *Hydrocolus persimilis* (Crotch 1873), new combination

Figs. 106E, F; 107C, D

Hydroporus persimilis Crotch 1873: 395. Type locality - Canada. Type not examined

Hydroporus aequus Fall 1923: 53. Type locality - Marion, Massachusetts. Type not examined.

Hydroporus acadianus Balfour-Browne 1948: 163. Type locality - Johnson Lake, near North Sydney, Cape Breton Island, Nova Scotia. Type not examined. NEW SYNONYMY.

Selected References. Fall 1923: 53; Fall 1932: 145; Hilsenhoff 1995: 16.

Description. Moderately large, length = 3.2 to 4.0 mm; width = 1.4 to 1.8 mm; length: width = 1.94 to 2.30. Body (Fig. 106E, F), in dorsal aspect, subparallel in outline, more parallel laterally than in related species, pronotum at its base subequal to or only slightly narrower than maximum width of elytra.

Color of dorsal surface pale yellowish brown to brown. Head anteriorly and lateral margins of pronotum and elytra paler. Ventral surface black except head, lateral portions of pronotum, epipleuron, prosternal process, metacoxal processes, and lateral spots on sterna 3 to 6, reddish. Antenna mainly yellow but at least apical antennomere lightly infuscate; palpi pale. Legs yellowish brown.

Head finely and relatively densely punctate, punctures much larger in size to those on disc of pronotum. Pronotum with punctures small on disc, coarser and larger toward margins, posterolaterally punctures more crowded. Elytron with punctures coarse and sparse and quite irregular, separated by about 1 to 5 times their diameter; epipleuron moderately, sparsely punctate. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 2 to 3 times their diameter. Abdomen with sternum 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 finely punctate; sternum 6 finely and sparsely punctate medially, punctures larger and denser laterally and posteriorly. Male with dorsal surface shiny but finely microreticulate, elytral meshes larger than those of pronotal disc; female specimens with sculpture more strongly impressed, some specimens with surface very dull and shagreened.

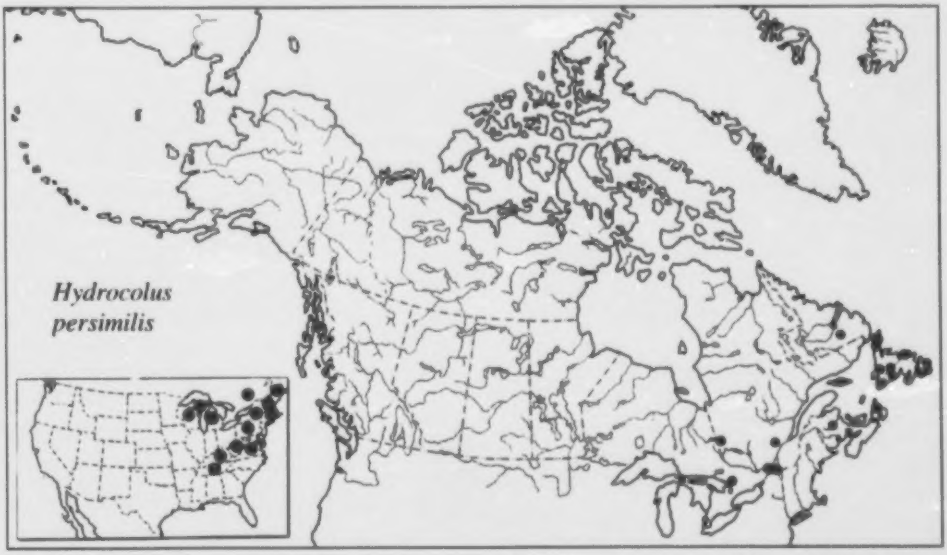
Eyes small and widely separated, WH1: WH2 = 1.35 to 1.50. Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.40 to 1.49. Pronotum in dorsal aspect uniformly curved laterally, with point of maximum width near hind angles; lateral margins not explanate; lateral bead distinct, about one-half to three-quarters width of apical antennomeres. Elytra in dorsal aspect rather parallel, widest behind mid-length, some specimens with humeral margin sinuate and narrower slightly posterior to pronotal-elytral juncture making pronotum appear more prominent. Body, in lateral aspect, depressed, metasternum distinctly impressed above level of prosternal process. Prosternum anteriorly with a low and indistinct, raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of prosternal process; prosternal process with file present, prosternal prominence high and rounded, blade broad and long, with a low, broad medial convexity, broadly margined basally, not margined and broadly rounded apically. Metacoxal lines almost parallel anteriorly.

Male and female protibia as in *H. paugus*. Aedeagus (Fig. 107C, D) in ventral aspect gradually constricted in apical quarter to third, apex narrow and needle-like.

Comments. This species differs from *H. paugus* in the same characters as given by Balfour-Browne (1948) for the separation of *H. acadianus* (Balfour-Browne) from *H. paugus*, thus it is very likely that *H. acadianus* is a junior synonym of *H. persimilis*. Balfour-Browne (1948) stated that the type specimen of *H. acadianus* was to sent to the Polish National Museum. However, the type material can not be found in that museum and therefore it was not examined. The synonymy given above is based on the descriptions. This species varies somewhat in habitus and the width of the pronotal bead but the variation is generally as great within populations as it is between populations.

Ecology. Specimens occur amongst moss in the cold water of small bog pools, seepage areas, the heads of small springs, and in saturated depressions in moss mats. The insects are slow moving and difficult to find among the moss, peat and other debris in which they occur.

Distribution. Map 125. This species occurs in northeastern North America. Collection records extend from Newfoundland, Labrador, Quebec and Wisconsin, south to Tennessee and Kentucky.



Map 125. ***Hydrocolus persimilis*** **(Crotch). Canadian and Alaskan collection localities and United States state records.**

4. *Hydrocolus oblitus* (Aubé 1838), new combination

Fig. 107E, F

Hydroporus oblitus Aubé 1838: 602. Type locality - United States.

Selected References. Sharp 1882: 453; Fall 1923: 51.

Description. Moderate sized, length = 2.8 to 3.4 mm; width = 1.5 to 1.7 mm; length: width = 1.94 to 2.10. Body, in dorsal aspect, elongate-oval in outline, rounded laterally and with maximum width near middle and distinctly wider at this point than pronotum across base.

Color of dorsal surface pale reddish to piceous. Head anteriorly and lateral margins of pronotum and elytra paler, disc of pronotum and elytra, of most specimens, almost black. Ventral surface largely black with head, antenna, palpi, prosternal process, lateral portions of pronotum, hind margins of sterna 3 to 6, a lateral spot on each of sterna 3 to 5, and legs reddish.

Head finely and sparsely punctate, punctures larger than those on disc of pronotum. Pronotum with sparse micropunctures on disc, coarser and larger toward margins, posterolaterally punctures crowded and forming ill-defined strigae on some specimens. Elytron with punctures small and dense, separated by about 1 to 2 times their diameter; epipleuron finely, sparsely punctate. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 3 to 5 times their diameter. Abdomen with sterna 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 finely punctate; sternum 6 finely and sparsely punctate medially, punctures larger but not denser laterally and posteriorly. Male dorsal surface shiny but finely microreticulate, elytral meshes subequal to those of pronotal disc; female with sculpture more strongly impressed, dull, shagreened specimens not seen.

Eyes relatively large, WH1: WH2 - 1.46 to 1.69. Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.32 to 1.58; pronotum in dorsal aspect evenly curved laterally with point of maximum width at hind angles; lateral margin not explanate; lateral bead narrow, less than half width of apical antennomeres. Elytra elongate oval, widest in basal third and not narrowed posterior to pronotal-elytral juncture. Body, in lateral aspect, depressed; metasternum distinctly impressed above level of prosternal process. Metacoxal lines almost parallel anteriorly. Prosternum anteriorly with a raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of prosternal process; prosternal process with file distinct, prosternal prominence low and rounded, blade narrow and long, with a broad and relatively high medial convexity, less broadly margined basally, not margined and narrowly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus (Fig. 107E, F) in ventral aspect gradually constricted in apical quarter to third, apex narrow and needle-like.

Comments. Although Fall (1923) referred to the members of *Hydrocolus* as the *Hydroporus oblitus*-group, he was quite uncertain as to the identity of *H. oblitus*. It is known that there are two, distinct species presently assigned to this name. These have been assigned to *H. oblitus* Aubé and "*H. oblitus sensu* Fall not Aubé" in various collections. The latter is described as a new species, *H. oblitoides*, below. The type series was not examined. However, a number of specimens were compared to the type series of *H. oblitus* by the late Frank Young and bear his labels which read: "Compared with Type, Sharp coll., ex. Missouri, Dejean Coll'n." Sharp (1882) acknowledges seeing Aubé's specimens via the Dejean collection.

These two species are similar in size and shape with only a few, consistent characters separating them: *H. oblitoides* has the prosternal process more broadly widened at the apex, and the blade with the medial convexity relatively flatter; the pronotum has the lateral bead much wider (and on certain specimens it is almost as wide as that of *H. persimilis* or *H. stagnalis*). The most striking difference however is in the form of the aedeagus; it is narrowed subapically and extended as a thin blade in *H. oblitus* (Fig. 107E, F) whereas it is evenly tapering and bluntly rounded apically in *H. oblitoides*.

Epler (1996) noted that in Florida *H. oblitus* is a complex which contains two species. However, he saw only female specimens and because females of some species within the genus are dimorphic in microsculpture and punctation, the two forms may be conspecific. All specimens in this complex, examined from Florida, are assigned to *H. oblitus*.

Ecology. Large series of this species were collected from very small, sand bottom streams in eastern Texas. The beetles were interstitial within the clean white, sand. Therefore it seems that this species does not have the same association with acidic, moss dominated habitats as other species in the genus. However, Young (1955) recorded specimens (as *Hydroporus* n.sp. cf. *oblitus* Aubé) from Glen Julia Springs, Florida, a cool spring flowing through aquatic mosses into a small pool. Specimens from Mississippi were collected in April and May at black light.

Distribution. This species is distributed along the Atlantic Coastal Plain from Massachusetts to Florida and along the Gulf Coast across to Texas. If the type series, referred to above, is truly from the state of Missouri (as opposed to the much broader and poorly delimited Missouri Territory) then it may extend northwards along low lying habitat to Missouri, which is not uncommon with Coastal Plain species. Because this species and its distribution are poorly known, all specimens examined are listed.

Specimens examined. **UNITED STATES**. ALABAMA. Mobile, H.P. Loding (1 USNM) Conecuh Co., Sandy Ck. At Co. Rd. 42, 1 km E Evergreen, 26.iv.1987, R.E. Roughley & R.G. Beutel colls. (2, JBWM), undercut stream bank; Conecuh Co., 10 km E Evergreen, Old Town Ck. at Why. 31, 29.iv.1987, R.E. Roughley & R.G. Beutel colls. (2, JBWM); Lee Co., marsh near Silver Run Creek, 21.vi.1979, F.N. Young (1, FNYC), #2787; Monroe Co., 0.2 km E. Peterman, Brushy Ck. at Rd. #30, 29.iv.1997, R.E. Roughley & R.G. Beutel colls. (1, JBWM), undercut stream bank; Tuscaloosa Co., 12 mi. NE Tuscaloosa, 21.v.1985, S.C. Harris (1, MSUC). FLORIDA. Alachua Co., 1.vi.1939, F. Young (1, USNM); Baker Co., ditch in McClenny, 15.v.1984, F.N. Young (6, FNYC), #3019; Calhoun Co., 5 mi. SSE Bloutstown, 7.v.1971, F.N. Young (1, FNYC), #2402; Duval Co., ditch near Baldwin, 15.v.1984, F.N. Young (1, FNYC), #3108; Gadsden Co., S. Ravine at Woodruff Dam, 13.vi.19S.Brown-F.N. Young (1, FNYC), #1084; Gadsden Co., Mt. Pleasant-Glen Julia Spgs., 9.vi.1954, S. Brown-F. Young (2, FNYC), #1056B; Jackson Co., stream near Oakdale, 30.v.1987, F.N. Young (1, FNYC), #3180; Liberty Co., stream at Hwy. 12, 10 km W of Wilma, 29.iv.1987, R.E.

Roughley & R.G. Beutel colls. (4, JBWM); Liberty Co., 10 mi. SE Telogia, 7.v.1971, F.N. Young (1, FNYC), #2410, stream-swamp; Suwannee Co., Suwannee River St. Pk., 24.vi.-14.vii.1977, J.R. Wiley (1, FNYC), B[lack] L[ight] T[rap]. GEORGIA. Baker Co., 3.6 km E. Elmodel on Hwy.37, 29.iv.1987, R.E. Roughley & R.G.Beutel colls. (1, JBWM), roadside pond; Bacon Co., Little Hurricane Ck. - US 23, 1.i.1981, F.N. Young (2, FNYC), #2858; Charlton Co., near St.George, 15.v.1984, F.N. Young (1, FNYC), #3021, stream; Clinton Co., 25.iii.1973, J.S. Ashe (1, JBWM); Dawson Co., 5 mi. W of Dawsonville, 27.vi.1962, F.N. Young, (1, FNYC), #1984; Decatur Co., S. Ravine at Woodruff Dam, 11.vi.1954, S. Brown - F. Young (2, FNYC), #1067B; Fanning Co., S. of McCaysville on Ga. 5, 27.vi.1962, F.N. Young (8, FNYC), #1979; Fulton Co., Atlanta - Fort MacPherson 23.iii.1943, F.N. Young (1, FNYC); Hart Co., near Muberg, 1.ix.1952, F.N. Young (1, FNYC), #972; Hart Co., woods stream nr. Nuberg, 4.vii.1980, F.N. Young (1, FNYC), #2848; Newton Co., 3 mi. E. Bricks Store, 28.vi.1962, F.N. Young, (1, FNYC), #1989. Oglethorpe Co., Big Indian Creek on GA 77, 24.vii.1979, F.N. Young (5, FNYC), #2808. LOUISIANA. Grant Par., 18 km N Alexandria, Stuart L. Camp, 12.v.-17.viii.1983, S. & J. Peck (1, CNCI) forest flight inter.; Rapides Par., Magnalia R.A., 12 mi. SW Alexandria, 27.iv.1976, A. Smetana, (11, CNCI); Rapides Par., 10 mi. W Alexandria, 29.iv.1976, A. Smetana (1, CNCI). MARYLAND. Bldnsbg, 17.ix (1 USNM). MISSISSIPPI. Lucedale, 8.vi.1930, H. Dietrich (2, FNYC); Calhoun Co., T11 S - 23 W Sec. 4, 12.vii.1978, D.F. Stanford (1, MSUC); Clarke Co., Allen Creek at US 64, 21.iv.1976, G.W. Wolfe, (1, FNYC), spring-seepage; Copiah Co., 3 mi W. Wesson, 26.iv.1987, S. Testa (6, MSUC); George Co., pool 6 mi W/ Pascagoula R., 17.vi.1960, F.N. Young (1, FNYC), #1770; Harrison Co., 3.3 mi. NE Saucier, 14.v.1984, P. K. Lago (1 MSUC); Leake Co., woods pond near Tupelo, 28.iii.1986, F.N. Young (7, FNYC), #3106; Potatoc Co., 32 km SW Tupelo, Tockshish mi. 250, 17.v-19.viii.1983, S. & J. Peck, (1 CNCI) oak forest flight intercept trap; Tishomingo Co., Tishomingo St. Pk., 9.vi.1984, P.K. Lago (1 MSUC). NORTH CAROLINA. Cherokee Co., S. Hiawasee Dam, 27.vi.1962, F.N. Young (1, FNYC), #1977. SOUTH CAROLINA. Union Co., 12.v.1975, J. F. Matta coll., (2 USNM). TENNESSEE. Mountain (1, CNCI). TEXAS. Hardin Co., 4 km E Sillsbee; Roy Larsen Sandylands Sanctuary, 18.v.1993, R.E. Roughley coll. (2 JBWM), sand-bottom stream. Jasper Co., 11 mi SE Zavalla, Boykin Springs, 16.v.1983, R.E. Roughley coll. (132, JBWM), stream; Montgomery Co., Rte. 1375, 18.2 km W New Waverley, 17.iv.1983, R.R. Murray, G.E. & K.E. Ball colls., (1, JBWM), 80 m., pine-oak for., temp. marsh. VIRGINIA. Charlotte Co., spring nr. Charlotte Ct. House, 29.vii.1959, F.N. Young (1, FNYC), #1469; Halifax Co., 4.vii.1975, J.F. Matta coll. (2, USNM); Hanover Co., 8.vii.1972, J.F. Matta coll. (1, USNM).

5. *Hydrocolus oblitoides* Roughley and Larson, new species

HOLOTYPE - male labelled as follows: USA, AR, Ozark Nat. For., Franklin Co., 2.5 km S Turner's Bend on Hwy. 23, 20.v.1986, [D.A.] Pollock [coll.]; in moss at edge of spring pool. Deposited in USNM. Nine paratypes with same label data to be distributed to various museums.

Etymology. The suffix, *-oides*, meaning like or similar to, added to oblitus to the resemblance in form to *H. oblitus*.

Selected Reference. Fall 1923: 51.

Description. Moderate size, length = 2.9 to 3.5 mm; length: width = 1.92 to 2.11. Body, in dorsal aspect, elongate-oval in outline, rounded laterally and with maximum width near middle and distinctly wider at this point than pronotum across base.

Color of dorsal surface pale reddish to dark brown, head anteriorly and lateral margins of pronotum and elytra paler, head posteriorly and disc of pronotum, of most specimens, dark brown. Ventral surface largely black with gula of head, antenna, palpi, prosternal process, lateral portions of pronotum, hind margins of sterna 3 to 6, a lateral spot on each of sterna 3 to 5, and legs reddish.

Head finely and more sparsely punctate, punctures larger than those on disc of pronotum. Pronotum with only few, sparse micropunctures on disc, punctures larger toward margins, posterolaterally punctures crowded and forming ill-defined strigae on some specimens. Elytron with punctures small, sparse and irregular, separated by about 2 to 5 times their diameter; epipleuron coarsely, sparsely punctate. Metasternum laterally with coarse, sparse punctures; disc of metacoxal plate with finer, very sparse punctures separated by 4 to 8 times their diameter. Abdomen with sternum 1 and 2 very sparsely and coarsely punctate laterally; sterna 3 to 5 finely punctate; sternum 6 finely and sparsely punctate medially, punctures larger but not denser laterally and posteriorly. Male dorsal surface shiny but finely microreticulate, elytral meshes subequal to those of pronotal disc; female with sculpture more strongly impressed, dull, shagreened specimens not seen.

Eyes relatively large, WH1: WH2 = 1.44 to 1.66. Pronotum broader than head, width of pronotum: width of head across eyes = 1.44 to 1.58; pronotum in dorsal aspect with lateral margin uniformly curved, with point of maximum width at hind angles; lateral margin not explanate laterally; lateral bead distinct, one-half to three-quarters width of apical antennomeres. Elytra elongate oval, widest in basal third and not narrowed posterior to pronotal-elytral juncture. Body in lateral aspect depressed, metasternum distinctly impressed above level of prosternal process. Metacoxal lines somewhat diverging anteriorly. Prosternum anteriorly with a raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of prosternal process; prosternal process with file distinct, prosternal prominence low and rounded, blade narrow and long, with a low and shallow medial convexity, less broadly margined basally, margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus in ventral aspect subparallel and not constricted in apical quarter to third, apex narrowly rounded.

Comments. Many other specimens from east of the Appalachian Mountains and north of the Coastal Plain were examined but are not designated as paratypes. The taxonomic problems in this group are such that it appears prudent to restrict the type material to a single locality. This species is the *H. oblitus* of Fall (1923) and not the true *H. oblitus* of Aubé (1838). Further comments under given under the treatment of *H. oblitus*.

Ecology. The type series was living interstitially within moss in a cold, spring pool. Most of the other specimens examined do not have associated ecological data.

Distribution. The distribution of this species can be described, loosely as north and west of that of the very similar *H. oblitus*. It is not found east of the Appalachian Mountains and most records are from sites relatively north of the Coastal Plain. Specimens examined are from Arkansas, Illinois, Indiana, and Pennsilvania.

6. *Hydrocolus rubyae* (Larson 1975), new combination

Figs. 106G; 107Q, R

Hydroporus rubyi Larson 1975: 290. Type locality - Township 1 Range 14 E, Manitoba [*H. rubyi* emended to *H. rubyae* Larson to correct gender]. Holotype male in CNC, examined.

Selected References. Larson 1975: 290; Hilsenhoff 1995: 16.

Description. Small, length = 2.6 to 3.2 mm; width = 1.3 to 1.5 mm; length: width = 1.90 to 2.17. Body, in dorsal aspect (Fig. 109G), subparallel in outline with maximum width behind middle and wider at this point than pronotum across base.

Color of dorsal surface dark brown to piceous, with head anteriorly and lateral margins of pronotum and elytra paler. Ventral surface dark brown to piceous with proepisternum, prosternal process, apical margins of abdominal sterna and lateral portions of sterna 3 to 6, paler. Antenna pale basally, infuscate distally; palpi yellow, infuscate apically.

Head finely and sparsely punctate, punctures subequal in size to larger punctures on disc of pronotum. Pronotum with micropunctures and small, scattered punctures on disc, punctures coarser toward margins, posterolaterally punctures more crowded, and forming ill-defined strigae on some specimens. Elytron with punctures coarse and sparse, separated by about 2 to 4 times their diameter; epipleuron coarsely, relatively densely punctate. Metasternum laterally and disc of metacoxal plate with coarse punctures; latter with punctures separated by 1 to 3 times their diameter. Abdomen with sternum 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 nearly impunctate; sternum 6 impunctate medially, punctures fine and sparse laterally and posteriorly. Male dorsal surface shiny but finely microreticulate, elytral meshes larger than those of pronotal disc; female specimens with sculpture more strongly impressed.

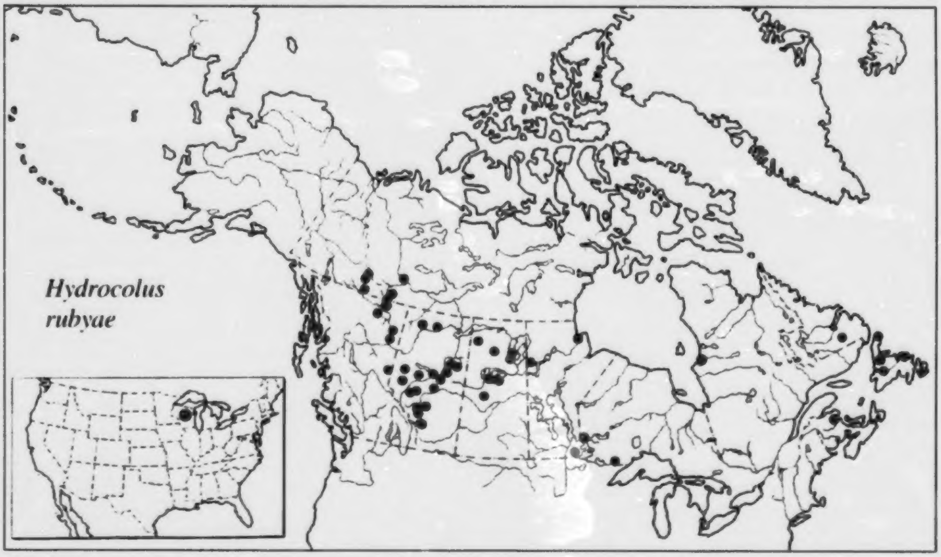
Head relatively broad, eyes small, WH1: WH2 = 1.40 to 1.55 . Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.35 to 1.40; lateral margin uniformly curved with point of maximum width at hind angles; lateral margin not explanate; lateral bead distinct, one-quarter to one-half width of apical antennomeres. Elytra subparallel, widest behind mid-length, some specimens with humeral margin sinuate, in dorsal aspect, and narrower slightly posterior to pronotal-elytral juncture making pronotum appear prominent. Body, in lateral aspect, quite depressed, metasternum not distinctly impressed above level of prosternal process. Metacoxal lines diverging anteriorly. Prosternum anteriorly very short with raised transverse ridge obscured; prosternal process with file poorly impressed to absent, prosternal prominence absent, blade less broad and longer, with a low, broad medial convexity, broadly margined basally, not margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus (Fig. 107Q, R) narrow, in dorsal aspect evenly tapering to narrowly rounded apex, in lateral aspect apex slightly curved ventrally.

Comments. Adults of this Nearctic species are similar in size, shape, color and form of the aedeagus to the Palaearctic species, *H. picicornis* (Sahlberg). Possible synonymy of these two species was investigated but observations suggest that the two species are distinct. For instance, specimens of *H. picicornis* have the pronotum and elytra much more convex in lateral aspect, and the punctation of the elytra is coarser than on specimens of *H. rubyae*. In addition, at the base of the elytral suture, immediately posterior to the medial lobe of the pronotum, specimens of *H. rubyae* have the apex of the scutellum visible whereas it is hidden in *H. picicornis*.

Ecology. Specimens occur in sphagnum bogs and fens, in flooded moss mats and in moss at the margin of very small pools.

Distribution. Map 126. This species occurs in the boreal zone, with records extending from Newfoundland to the central Yukon Territories and south to Wisconsin.



Map 126. *Hydrocolus rubyae* (Larson). Canadian and Alaskan collection localities and United States state records.

7. *Hydrocolus filiolus* (Fall 1923), new combination

Fig. 107M – O

Hydroporus filiolus Fall 1923: 52 – 53. Type locality - Alexandria Co., Virginia. Type not examined.

Selected Reference. Fall 1923: 52 – 53.

Description. Small, length = 2.6 to 3.2 mm; width = 1.3 to 1.4 mm; length: width = 1.91 to 2.12. Body, in dorsal aspect, subparallel in outline, and with maximum width behind middle and somewhat to distinctly wider at this point than pronotum across base.

Color of dorsal surface reddish yellow. Ventral surface with head (gula only on some specimens), antenna, palpi, lateral portions of pronotum, epipleuron and legs yellowish red; remainder black except posterior margins of sterna 3 to 6, reddish.

Head finely and sparsely punctate, punctures subequal in size to larger punctures on disc of pronotum. Pronotum with micropunctures and small, scattered punctures on disc, punctures coarser and larger toward margins, posterolaterally punctures more crowded, and forming ill-defined strigae on some specimens. Elytron with punctures only moderately coarse and dense, separated by about 2 to 3 times their diameter, some specimens with very large, tear-drop shaped punctures irregularly across base; epipleuron coarsely, very sparsely punctate, except densely punctate near base on some specimens. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 2 to 4 times their diameter. Abdomen with sternum 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 nearly impunctate; sternum 6 impunctate medially, punctures fine and sparse laterally and posteriorly. Male dorsal surface shiny but finely microreticulate, elytral meshes subequal to those of pronotal disc; female with sculpture more strongly impressed.

Eyes relatively small, WH1: WH2 = 1.41 to 1.52. Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.40 to 1.64; pronotum in dorsal aspect with lateral margin uniformly curved with point of maximum width at hind angles; lateral margin not explanate laterally; lateral bead distinct, about one-quarter to one-half basal width of apical antennomeres. Elytra in dorsal aspect parallel, widest behind middle, some specimens with humeral margin sinuate and narrower slightly posterior to pronotal-elytral juncture making pronotum appear prominent. Body, in lateral aspect, depressed, metasternum distinctly impressed above level of prosternal process. Metacoxal lines parallel anteriorly. Prosternum anteriorly very short with raised transverse ridge obscured; prosternal process with file present, prosternal prominence low and rounded, blade broad and short, with a relatively low and flat medial convexity, broadly margined basally, not margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus (Fig. 107 M – O) short, in dorsal aspect, not abruptly constricted in apical quarter to third, shaft narrowing distally with apex bluntly pointed; apex in lateral aspect faintly sinuate on ventral margin.

Comments. Fall (1923:53) described this as a species of convenience which verges "... uncomfortably close to the still more dubious *oblitus*". This species is quite similar to specimens of *H. rubyae* and *H. rufiplanulus* and specimens are best separated by the characters given in the key. The concept of this species is based on examination of a number of topotypical specimens and although it is decidedly variable, there appear to be sufficient features to consider it a distinct species.

Ecology. The habitat has not been described adequately, but it probably occurs among mosses in springs and seeps. Chamberlain (1947) recorded three specimens taken from wet moss along the margin of a cold spring in New York State. Young (1955), in a study of the water beetle fauna of Glen Julia Springs in Florida, took one specimen from a cool spring flowing through aquatic mosses into a small pool. We have examined this specimen and have tentatively assigned it to this species although all of the other specimens assigned to this name came from more northern locales.

Distribution. The range extends from New Hampshire and New York to Virginia with a lone record from northern Florida. There are no Canadian records but occurrence in New Brunswick or southern Quebec is likely.

8. *Hydrocolus rufiplanulus* (Fall 1923), new combination

Fig. 107P

Hydroporus rufiplanulus Fall 1923: 53 – 54. Type locality - Rock City, Cattaraugus Co., New York. Type not examined.

Selected Reference. Fall 1923: 53 – 54.

Description. Small, length = 2.8 to 3.4 mm; width = 1.3 to 1.4 mm; length: width = 1.92 to 2.21. Body, in dorsal aspect, subparallel in outline with maximum width behind middle, pronotum at widest point broader than elytra across base thus body outline discontinuous.

Color of dorsal surface uniformly pale reddish. Ventral surface with head, antenna, palpi lateral portions of pronotum, mesepimeron, epipleuron and legs yellowish; remainder light reddish brown except sternum 6, yellow.

Head finely and sparsely punctate, punctures subequal in size to larger punctures on disc of pronotum. Pronotum with micropunctures and small, scattered punctures on disc, punctures coarser and larger toward margins, posterolaterally punctures more crowded and forming ill-defined strigae on some specimens. Elytron with punctures coarse and sparse, separated by about 2 to 5 times their diameter; epipleuron coarsely and sparsely punctate. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 2 to 4 times their diameter. Abdomen with sternum 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 finely and sparsely punctate; sternum 6 impunctate medially, punctures fine and sparse laterally and posteriorly. Male dorsal surface shiny but finely microreticulate, elytral meshes subequal to those of pronotal disc; female with sculpture more strongly impressed.

Eyes relatively small and widely separated, WH1: WH2 = 1.40 to 1.66. Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.41 to 1.63; pronotum in dorsal aspect with point of maximum width well in front of hind angles; lateral margins not explanate laterally; lateral bead broad, at widest subequal to basal width of apical antennomeres. Elytra widest behind mid-length, some specimens with humeral margin sinuate, in dorsal aspect, and narrower slightly posterior to pronotal-elytral juncture making pronotum appear quite prominent. Body in lateral aspect, depressed, metasternum distinctly impressed above level of prosternal process. Metacoxal lines diverging anteriorly. Prosternum anteriorly very short with raised transverse ridge obscured; prosternal process with file present, prosternal prominence low and rounded, blade broad and short, with a relatively high, broad medial convexity, broadly margined basally, not margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus, in dorsal aspect (Fig. 107P), with sides subparallel medially, apex evenly narrowed to a blunt point.

Comments. Specimens from the northern part of the range are quite distinctive, resembling *H. stagnalis* in the broad pronotal bead but differing in slightly smaller size, flatter body form and coarse, more irregular punctation of the elytra as well as differences in the form of the aedeagus. From specimens of *H. rubyae* and *H. filiolus* it is separated by a slightly larger size, body more depressed and subparallel but with pronotum broader at point of maximum width and wider than elytra across base and more arcuate laterally than elytra basally so that the lateral margin of the body is discontinuous in outline in dorsal aspect.

Ecology. Specimens were collected at Mt. Sutton, Quebec, from a mossy seep on the slope of a winter ski hill. Chamberlain (1947) recorded two series of specimens taken from wet moss along the margin of a cold spring in the low rolling hills of the Taconic Mountains, eastern New York State. He took these specimens by treading water-soaked moss.

Distribution. Map 128. There is only one locality record for Canada [QUEBEC. Mt. Sutton nr. Sutton, 10.vi.1986, mossy seep at base of ski hill, R.E. Roughley coll. (5, JBWM)]. It appears to be principally an Appalachian species distributed from Quebec east to Maine and south to Virginia.

9. *Hydrocolus stagnalis* (Gemminger & Harold 1868), new combination

Figs. 106D; 107I – L

Hydroporus collaris LeConte 1855: 297. Type locality - Lake Superior. Type not examined. Not Hope 1842.

Hydroporus stagnalis Gemminger and Harold 1868: 441. New name for *H. collaris* LeConte.

Selected References. Fall 1923: 52; Larson 1975: 291; Hilsenhoff 1995: 16.

Description. Moderately large, length = 3.0 to 3.7 mm; width = 1.5 to 1.7 mm; length: width = 1.81 to 2.15. Body in dorsal aspect (Fig. 106D) rounded to subparallel in outline, with maximum width near or posterad of middle; more convex dorsally than similar species of group.

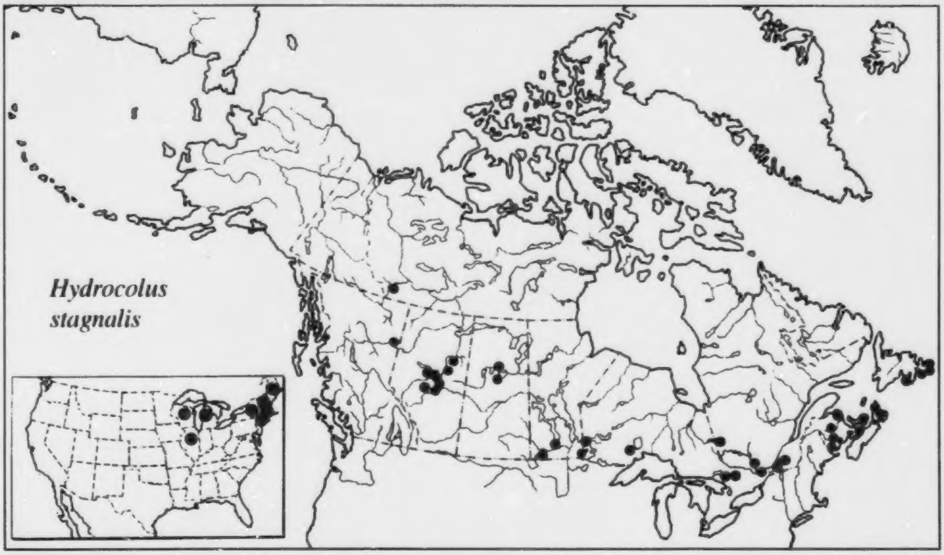
Color of dorsal surface pale reddish brown to dark brown, head anteriorly and lateral margins of pronotum and elytra yellowish. Ventral surface with head, antenna (outer antennomeres infuscate), palpi, lateral portions of pronotum, epipleuron and legs yellowish brown; remainder dark brown to black except metacoxal processes, and posterior margins on sterna 3 to 6, reddish.

Head finely and relatively densely punctate, punctures subequal in size to larger punctures on disc of pronotum. Pronotum with micropunctures and a few small, scattered punctures on disc, punctures coarser and larger toward margins, posterolaterally punctures more crowded, and forming ill-defined strigae on some specimens. Elytron with punctures coarse and sparse, separated by about 2 to 3 times their diameter; epipleuron coarsely, sparsely punctate. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 2 to 3 times their diameter. Abdomen with sternum 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 finely punctate; sternum 6 impunctate medially, punctures fine and sparse laterally and posteriorly. Male dorsal surface shiny but finely microreticulate, elytral meshes subequal to those of pronotal disc; female specimens with sculpture more strongly impressed, some specimens with surface very dull and shagreened.

Eyes relatively small, WH1: WH2 = 1.40 to 1.66. Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.40 to 1.66; at widest only slightly narrower than elytra across widest point; pronotum in dorsal aspect with lateral margin uniformly curved, with point of maximum width near or before hind angles; lateral margin not explanate laterally; lateral bead very broad, equal to width of apical antennomeres. Elytra parallel to ovate, widest behind mid-length, some specimens with humeral margin sinuate, in dorsal aspect, and narrower slightly posterior to pronotal-elytral juncture making pronotum appear more prominent. Body in lateral aspect more convex than in similar-sized species, metasternum distinctly impressed above level of prosternal process. Metacoxal lines diverging anteriorly. Prosternum anteriorly with a low and indistinct, raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of prosternal process; prosternal process with file present, prosternal prominence low and rounded, blade narrow and long, with a relatively high, broad medial convexity, broadly margined basally, not margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus (Fig. 107I - L), in ventral aspect, not constricted in apical quarter to third, gradually narrowing to bluntly pointed apex; in lateral aspect, distinctly sinuate apically, ventral margin with fine serrations or spicules.

Comments. This species is somewhat variable in size, habitus and shape of the aedeagus so that it is possible that it is a composite species. Typical specimens which have a very broad pronotal bead and the pronotum rounded laterally and narrowed posteriorly are easily assigned to this name. However specimens with a somewhat narrower, lateral pronotal bead and/or a more tapered pronotum can be confused with those of *H. rufiplanulus* or *H. oblitoides*. Fig. 107 I – L shows the range of variation in form of the median lobe of the aedeagus of *H. stagnalis*.



Map 127. *Hydrocolus stagnalis* (Gemminger and Harold). Canadian and Alaskan collection localities and United States state records.

Ecology. These insects usually occur in saturated mosses at the margins of small, cold pools. They occur in coastal barren pools in Newfoundland but Larson (1975) also recorded specimens from willow-shaded pools near a small, cold creek. Hilsenhoff (1995) collected a series of specimens from shallow water of a recently-flooded *Carex* marsh as well as from other similar temporary habitats.

Distribution. Map 127. The range extends from Newfoundland to northern British Columbia and the Northwest Territories and south to Rhode Island, Illinois and Wisconsin.

10. *Hydrocolus rupinus* Roughley and Larson, new species

Fig. 107G, H

HOLOTYPE - male, labelled as follows: USA, GA, Dade Co., Cloudland Cyn. St. Pk., 14.v.1986, B.J. Sinclair coll.; seepage (petrimadicole) east side Upper Falls. Deposited in USNM.

ALLOTYPE - female, and one PARATYPE (female) with same label data. In JBWM.

Etymology. From the Latin, *rupina*, meaning a rocky chasm which aptly describes the type locality.

Description. Moderately large, length = 3.6 to 3.7 mm; length: width = 1.94 to 1.98. Body, in dorsal aspect, broadly rounded in outline and distinctly attenuate posteriorly, with maximum width at middle and somewhat to distinctly wider at this point than pronotum across base; body in lateral aspect somewhat depressed.

Color of dorsal surface dark brown to piceous, head anteriorly and lateral margins of pronotum reddish. Ventral surface with head, palpi, and lateral portions of pronotum brown; remainder black except metacoxal processes, and posterior margins on sterna 3 to 6, dark reddish. Anterior legs, mesocoxa, mesotrochanter, mesotibia and metatrochanter yellowish red, remainder of middle and hind legs brown.

Head finely and relatively densely punctate, punctures subequal in size to larger punctures on disc of pronotum. Pronotum with micropunctures and many, small, scattered punctures on disc, punctures coarser and larger toward margins, posterolaterally punctures more crowded, and forming ill-defined strigae. Elytron with punctures coarse and dense, separated by about 1 to 2 times their diameter; epipleuron coarsely, sparsely punctate. Metasternum laterally and disc of metacoxal plate with coarse, sparse punctures; latter with punctures separated by 2 to 3 times their diameter. Abdomen with sterna 1 and 2 sparsely and coarsely punctate laterally; sterna 3 to 5 finely and sparsely punctate; sternum 6 with punctures fine and moderately dense laterally and posteriorly. Male dorsal surface finely microreticulate, elytral meshes smaller than those of pronotal disc; female specimens with sculpture more strongly impressed.

Eyes relatively large, WH1: WH2 = 1.54 to 1.58. Pronotum somewhat broader than head, width of pronotum: width of head across eyes = 1.50 to 1.57; pronotum in dorsal aspect uniformly curved laterally, with point of maximum width at or near hind angles; lateral margins somewhat explanate laterally; lateral bead distinct, one-half width of apical antennomeres. Elytra oval, widest before mid-length, with humeral margin sinuate in dorsal aspect, and narrower slightly posterior to pronotal-elytral juncture making pronotum appear more prominent. Body, in lateral aspect, depressed, metasternum distinctly impressed above level of prosternal process. Metacoxal lines more or less parallel anteriorly. Prosternum anteriorly with a well impressed, distinct, raised transverse ridge, distinctly swollen anterior to procoxae, impressed at base of prosternal process; prosternal process with file present, prosternal prominence absent, blade broad and short, with a relatively low, broad medial convexity, very broadly margined basally, not margined and broadly rounded apically.

Male and female protibia as in *H. deflatus*. Aedeagus (Fig. 107G, H), in ventral aspect, broadened in apical quarter, abruptly narrowing to bluntly pointed apex.

Comments. Although this species is only known from three specimens it seems quite distinct and should not be easily confused with any other species in the genus.

Ecology. The type series was collected from saturated mosses of a seepage at the margins of a waterfall on Daniel Creek as it flows down Lookout Mountain through the rugged and precipitous Cloudland Canyon State Park.

Distribution. Presently known only from the type locality near the town of Rising Fawn, Dade Co. in the extreme northwest of the state of Georgia. This locality is on the edge of the Cumberland Plateau and this species is probably more widely distributed in similar habitats on the Cumberland Plateau.

Genus *Stictotarsus* Zimmermann, 1919

Figs. 23H, I; 108 - 112.

Stictotarsus Zimmermann 1919: 184. Type species. *Dytiscus duodecimpustulatus* Fabricius (designated by J. Balfour-Browne 1944).

Hydroporus in part: Fall 1923, Larson 1975.

Deronectes: Leech and Chandler 1956, Zimmerman and A. Smith 1975, Zimmerman 1982.

Potamonectes (*Trichonectes*): Pederzani 1995.

Diagnosis. North American species only. Length = 3.3 to 6.4 mm. Body shape various, from short and broadly ovate to elongate; lateral outline continuous to strongly discontinuous.

Dorsal surface of most specimens maculate, pale with dark blotches or longitudinal vittae, or some specimens almost entirely black or black with pale spots. Dorsal surface of body finely and densely punctate, with conspicuous short setose or not; ventral surface and ventral face of metafemur densely and finely punctate; metatibia with ventral face punctate or not.

Pronotum lacking well defined sublateral longitudinal impressions or plicae; lateral bead fine to broad and inflated. Elytron disc of many specimens with impressed longitudinal striae; lateral margin lacking a subapical tooth; lateral margin in lateral aspect ascendant to humeral angle; epipleuron without a vertical carina on shoulder. Prosternum with file obsolete, prominence evident or not; prosternal process of varied shape, elongate and narrow to short and broad, with or without a distinct median ridge; process not contacting anteromedial lobe of metasternum and mesocoxae contiguous, or contacting metasternum and narrowly to broadly separating mesocoxae. Metacoxal processes (Figs. 23H, I; 109B; 112B) conjointly with hind margin medially emarginate, midline incised; interlaminar bridge of metacoxa (Zimmerman 1982) hidden below metacoxal processes or extended posteriorly and visible.

Male protarsomeres ventrally without enlarged adhesive scales. Parameres (Fig. 108H, 109C) symmetrical, pointed and setose apically, without a sclerotized apical hook; aedeagus simple, apex entire or shallowly emarginate.

Comments. The North American members of this genus have been variously treated as members of *Hydroporus* (Fall 1923; Larson 1975), a subgenus of *Hydroporus* (e.g., subgenus *Deronectes* Sharp), or as members of the genera *Deronectes* (Leech and Chandler 1956; Zimmerman and A. Smith 1975) or *Potamonectes* Zimmermann (Pederzani 1995). Zimmerman (1982) suggested that certain of these species may be assignable to *Stictotarsus*, but it was Nilsson and Angus (1992) who redefined *Stictotarsus* and formally assigned North American species to the genus. *Stictotarsus* (sensu Nilsson and Angus 1992, and followed here) contains species in the Palaearctic region including North Africa but the majority of species, about 23, occur in North America, with the greatest regional diversity being in the southwestern United States. The genus as so defined is rather heterogeneous. The type species, *S. duodecimpustulatus* (Fabricius) differs from North American species in a number of ways, the most striking being its asymmetric parameres and elongate, twisted aedeagus. Pederzani (1995), on the other hand, restricted *Stictotarsus* to include only two species from the western Palaearctic region and assigned Nearctic species to *Potamonectes*, subgenus *Trichonectes* Guignot. The Nearctic species do not belong in *Potamonectes* as demonstrated by Nilsson and Angus (1992) but the name *Trichonectes* may be applicable although we do not know the type species (*Potamonectes otini* Guignot) or its characteristics. It is certain the last word has not been said about the generic placement of these species and it is likely that the long suffering non-taxonomists are going to be subjected to more name changes in the future.

A key to the species of Canada and the United States is presented below. This key is based on keys by Leech and Chandler (1956), Zimmerman and A. Smith (1975) and Zimmerman (1982) but also includes new characters and an additional species. Several included species can be recognized only on the basis of distribution and may prove to be synonyms (e.g., *S. grammicus* and *S. titulus*; *S. coelamboides* and *S. panaminti*). Zimmerman (1982) had too few specimens to resolve some of these problems and as we have seen even less material we hesitate to propose new synonymy.

These insects occur in both lentic and lotic habitats. They are generally found on mineral substrates although some also occur over silty bottoms, usually where aquatic plants are sparse. Most species occur in freshwater, but a few species such as *S. spenceri* and members of the *S. coelamboides* complex occur, to some extent, in saline waters.

Key to species of *Stictotarsus* of Canada and the United States

1. Metatibia with ventral surface finely micropunctate in addition to bearing a longitudinal row of coarse punctures .2

1'. Metatibia with a longitudinal row of coarse punctures on ventral face, otherwise ventral face impunctate 5

2(1). Prosternal process short and not contacting anteromedial lobe of metasternum, mesocoxae contiguous (Fig. 108D); head in lateral aspect with clypeus produced anteriorly as a sharp ridge (Fig. 108B); length = 4.4 mm; length: width = 2.12 . . . . .1. *S. minipi* (Larson)

2'. Prosternal process more elongate, contacting anteromedial lobe of metasternum and separating mesocoxae; head in lateral aspect with clypeus rounded and not protruding as a sharp ridge 3

3(2). Pronotum entirely pale, without dark markings; aedeagus in dorsal aspect with apex narrowly pointed; length = 4.9 to 5.4 mm; length: width = 1.96; western Texas and New Mexico . . . .*S. neomexicanus* (Zimmerman and A. Smith 1975)

3'. Pronotum darkened along apical and basal margins; aedeagus in dorsal aspect with apex broad and broadly rounded 4

4(3). New Mexico; length = 5.4 to 6.0 mm; length: width = 2.04 . . . .*S. grammicus* (Sharp 1887)

4'. Texas, Big Bend Park; measurements as for *S. grammicus* [possibly a synonym of *S. grammicus*] . . . .*S. titulus* (Leech 1945*b*)

5(1). Metacoxal lines closely spaced and more or less parallel anterior to lobes of metacoxal processes (Figs. 23I; 109B); large species, length = 5.4 to 6.4 mm; length: width = 2.02; Yukon to Alberta and Utah . . . . .2. *S. spenceri* (Leech)

5'. Metacoxal lines distinctly diverging anterior to metacoxal lobes (Figs.23H; 112B); smaller, length = 3.3 to 5.7 mm 6

6(5). Metatarsomere 1 with several to many erect setae on distal portion of dorsomesal margin 7

6'. Metatarsomere 1 lacking erect setae on dorsal surface 9

7(6). Body dorsally dark reddish brown to black, pronotum dark or some specimens with a small medial spot and spot near each anterolateral angle paler; California 8

7'. Body dorsally with variegated reddish yellow and black markings, pronotum reddish yellow medially with lateral margins narrowly and apical and basal margins more broadly black (Fig. 110A); length = 3.3 to 4.8 mm; length: width = 1.87; Alberta to Texas, Arizona and Mexico . . . . .3. *S. aequinoctialis* (Clark)

8(7). Smaller species, length = 4.6 to 5.1 mm; pronotum with lateral bead only slightly widened posteriorly; pronotum with few or no rugae, surface often reticulate between punctures which are evenly distributed and only slightly larger than those of elytra; elytra black; length: width = 1.87; California, Coachella Valley to Fresno and Ventura Counties . . . .*S. dolerosus* (Leech 1945*b*)

8'. Larger species, length = 4.8 to 5.7 mm; pronotum with lateral bead gradually widening from apex to base, where it is at least one half as wide as a median antennomere; pronotum with longitudinal rugae at sides and base, surface shiny between punctures which are irregular in size and distribution and much larger than those of elytra; elytra usually maculate; length: width = 1.87; southern California to Palm Springs .... *S. funereus* (Crotch 1973)

9(6). Pronotum with posterolateral angle broadly rounded and obsolete; head entirely pale, pronotum pale or some specimens medially on disc with a slight suffusion of pigment on each side of middle and hind margin with a variously developed black band; male mesotibia swollen apically, ventral margin sinuate in lateral aspect and carinate in basal half 10

9'. Pronotum with posterolateral angle distinct, right angled to slightly rounded and narrowly obtuse; head and pronotum color various, if mainly pale, pronotum with a bilobed black mark along basal margin; male mesotibia not modified 11

10(9). Length = 4.2 to 4.8 mm; southeastern California to New Mexico .... *S. coelamboides* (Fall 1923)

10'. Length = 3.5 to 4.0 mm; southeast California, Death Valley, Inyo County .... *S. panaminti* (Fall 1923)

11(9). Mesocoxae narrowly separated, distance between them subequal to or less than minimum distance between procoxae; metasternum with anteromedial lobe narrow, its apex slightly flattened or impressed where it contacts apex of prosternal process; ventral surface of head with a crease behind eye; body shape various but many specimens more elongate, length: width 1.76 to 2.06 12

11'. Mesocoxae widely separated, distance between them 1.25 to more than two times greater than minimum distance between procoxae; metasternum with anteromedial lobe broad, its apex with a distinct V-shaped impression for reception of apex of prosternal process; head ventrally without a crease behind eye; body broad, length: width less than 1.80 14

12(11). Body broadly oval (Fig. 111A), length: width = 1.76 to 1.92; elytron with an evidently impressed subsutural striae and from one to four additional longitudinal striae on disc; length = 3.8 to 4.7 mm; widespread, Manitoba to Alaska and south to western Texas, New Mexico, Arizona and California .... 4. *S. striatellus* (LeConte)

12'. Body more elongate, length: width = 1.90 to 2.06; elytron without impressed striae; length = 3.7 to 5.3 mm 13

13(12). Transcontinental and northern, throughout area except southeastern United States and southern Great Plains; in California and Oregon prosternal prominence present or absent, proepisternum entirely black;

male protarsal claws shorter than or subequal to protarsomere 5; aedeagus more evenly arcuate, without a distinct medial angulation (Fig. 112C); length = 3.7 to 5.3 mm; length: width = 1.91 to 2.06 .... 5. *S. griseostriatus* (DeGeer)

13'. Oregon and California; prosternal prominence well developed; proepisternum yellow; male protarsal claws subequal to or longer than protarsomere 5; aedeagus in lateral aspect with an angulate medial bend; length = 3.9 to 4.5 mm; length: width = 1.96 *S. expositus* (Fall 1923)

14(11). Head in anterior aspect with a rounded but more or less well defined ridge that extends from above antennal base towards middle and on most specimens apparent clear across face; metacoxa with interlaminar bridge clearly exposed behind metacoxal processes; pronotum with discal area generally dark except some specimens with a small pale spot medially; length = 4.1 to 5.1 mm; length: width = 1.75; New Mexico and Arizona .... *S. corvinus* (Sharp 1887)

14'. Head with frontal ridge not so well developed, evident laterally above base of antenna but becoming obsolete at level of lateral portion of labrum and not traceable across front of head; metacoxa with interlaminar bridge hidden below metacoxal processes and not exposed behind; pronotum of most specimens with variously developed pale areas on disc 15

15(14). Elytron with markings on at least apical half frothy, i.e. of irregular shape and intensity; western Texas to Arizona; length = 4.1 to 4.8 mm; length: width = 1.74 .... *S. roffi* (Clark 1862)

15'. Dark elytral markings of solid color and more evidently blotchy or vittaform 16

16(15). Elytron with a sublateral vitta limited laterally by subsutural row of punctures and separated from dark sutural margin by longitudinal yellow stripes, at least medially and subapically; elytron disc with more or less distinct narrow longitudinal dark vittae; head largely yellow; length = 4.0 to 4.8 mm; length: width = 1.69; New Mexico .... *S. corpulentus* (Fall 1923)

16'. Elytron with area between sutural margin and subsutural row of punctures uniformly black; elytron disc with dark markings of various forms but not consisting of several narrow longitudinal vittae; head color various, many specimens with expanded dark markings 17

17(16). Specimens from Texas to Arizona 18

17'. Specimens from California 19

18(17). Head dorsally mainly dark with a delimited frontal bar between hind margins of eyes; pronotum with disc generally dark; length = 4.0 to 4.4 mm; length: width = 1.67; New Mexico and Arizona .... *S. decemsignatus* (Clark 1862)

18'. Head dorsally mostly pale, frons yellow medially and broadly continuous with yellow anterior margin, without a defined frontal bar; pronotal disc pale with darkening along apical and basal margins; length = 4.1 to 4.8 mm; length: width = 1.65; New Mexico and Arizona . . . .*S. spectabilis* (Zimmerman 1982)

19(17). Elytron with a sutural and one or more discal series of punctures but discal series confused posteriorly (Fig. 110B); ventral surface reddish to reddish brown; metacoxal lines widely divergent anteriorly; aedeagus in dorsal aspect with sides subparallel apically and tip bluntly rounded; length = 3.8 to 4.5 mm; length: width = 1.67; southern California . . . . .6. *S. deceptus* (Fall)

19'. Elytron with three series of lightly impressed punctures; ventral surface nearly black; metacoxal lines less divergent anteriorly; aedeagus in dorsal aspect with apex broadened and rounded; length = 3.9 to 4.9 mm; length: width = 1.75; southern California . . . .*S. eximius* (Motschulsky 1859)

1. *Stictotarsus minipi* (Larson 1991)

Fig. 108

Potamonectes minipi Larson 1991*a*: 280 – 284. Type locality – Labrador, Anne Marie Lake, Minipi Drainage. Type in CNC.

Description. Length = 4.4 mm; width = 2.1 mm; length: width = 2.11. Habitus (Fig. 108A, B) elongate, lateral outline strongly discontinuous; body dorsoventrally depressed.

Body dorsally pale yellow with darker maculations (Fig. 108A). Head dorsally pale brown, gradually paling to yellow on clypeus, posterior margin piceous; palpi yellow, terminal palpomere of each palpus infuscate apically; antenna yellow, progressively infuscate apically from antennomere 7. Pronotum with a pair of large piceous spots medially on disc, area laterad to each spot diffusely pale brown. Elytron with longitudinal piceous vittae as follows, narrow sutural margin, disc medially with 5 more or less complete discal vittae, vitta 6 short and broken medially and vitta 7 present as several small mediolateral longitudinal spots; epipleuron yellow. Ventral surface black except proepipleuron and proepisternum yellow, sternum 6 rufous. Legs yellow.

Pronotum and elytron with evident but sparse, fine setae. Pronotum medially with sparse setiferous punctures, densest near lateral margins, and numerous fine punctures. Elytron with dense, small punctures separated by own diameters, apparently only a portion of punctures bearing setae; interspaces shiny with lightly impressed microsculpture; epipleuron densely and finely micropunctate. Prosternum with coarse setiferous punctures bearing elongate, decumbent yellow setae; prosternal process coarsely punctate, blade of process bearing erect, short, brown bristles. Remainder of ventral surface with dense, fine punctures; scattered setiferous punctures present, most densely in intralinear space of metacoxa. Legs with femora finely and densely punctate; metatibia with ventral face finely punctate but less so than femur; metatarsomeres with dorsal surface impunctate.

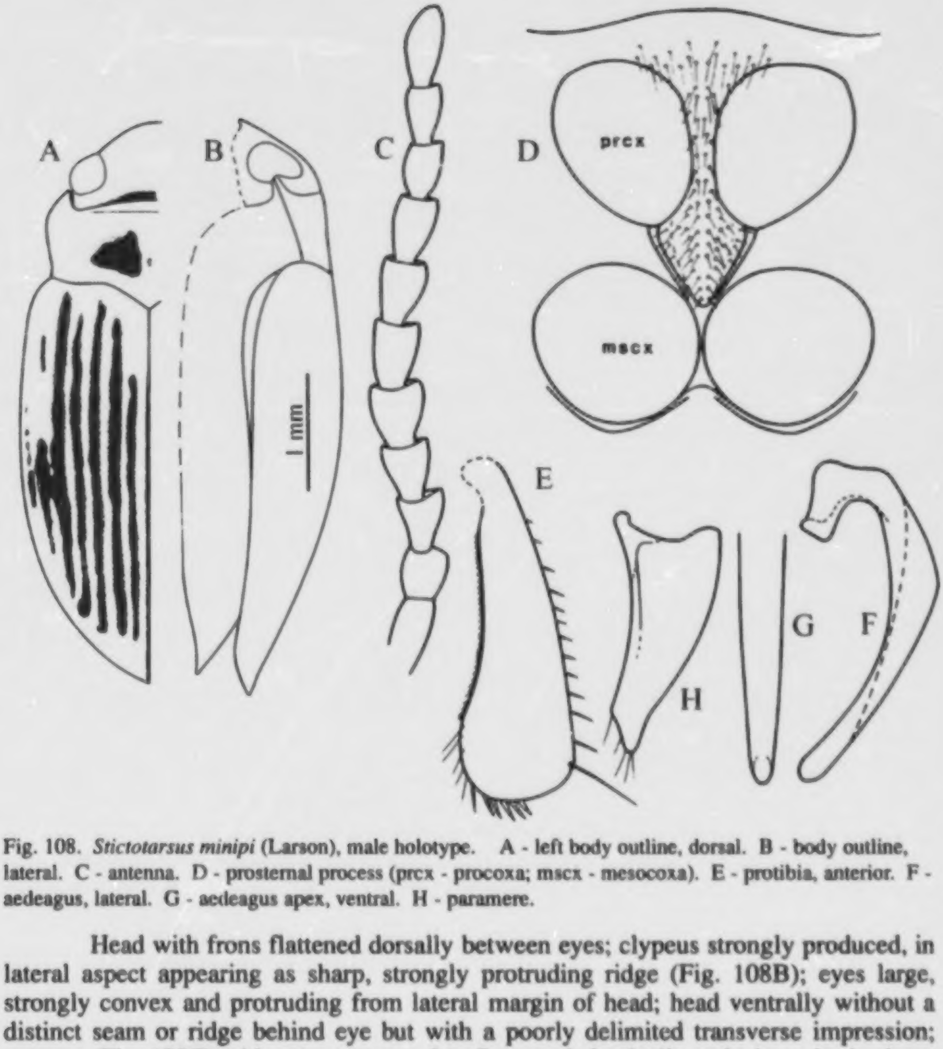


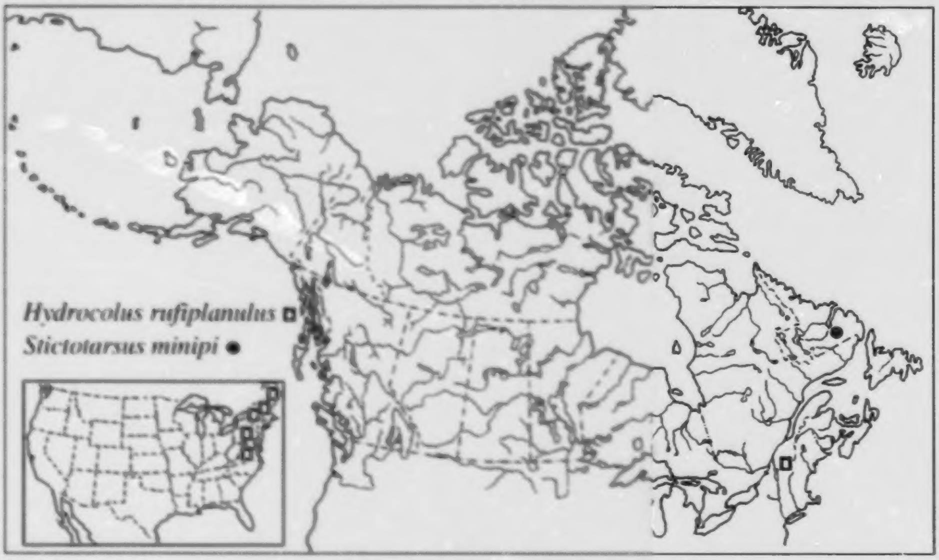
Fig. 108. *Stictotarsus minipi* (Larson), male holotype. A - left body outline, dorsal. B - body outline, lateral. C - antenna. D - prosternal process (prcx - procoxa; mscx - mesocoxa). E - protibia, anterior. F - aedeagus, lateral. G - aedeagus apex, ventral. H - paramere.

Head with frons flattened dorsally between eyes; clypeus strongly produced, in lateral aspect appearing as sharp, strongly protruding ridge (Fig. 108B); eyes large, strongly convex and protruding from lateral margin of head; head ventrally without a distinct seam or ridge behind eye but with a poorly delimited transverse impression; antenna (Fig. 108C) with antennomeres 2 to 7 expanded apically and triangular in shape in dorsal aspect. Pronotum short, lateral margin sinuate, widest slightly behind base of front angles, narrower posteriorly and sinuate to sharp, denticulate posterolateral angle; lateral bead narrow. Elytron with lateral margin strongly ascendant to humeral angle in lateral aspect, epipleuron not visible to base. Prosternum (Fig. 108D) with process slightly tumid basally in lateral aspect; prosternal process short, ovate and bluntly pointed apically, smoothly and strongly convex in cross section, not attaining level of metasternum thus mesocoxae contiguous. Metacoxal lines gradually diverging anteriorly.

Male protibia (Fig. 108E) dilated apically into a rounded lobe on mesal side, mesal margin concave; protarsal claws slender, subequal in length and unmodified. Aedeagus (Fig. 108F, G) with apex bluntly pointed, shaft in lateral aspect with a medial, dorsal bulge.

Ecology. The holotype, the only known specimen, was collected along with a series of *Oreodytes laevis* (Kirby) from along the sandy shoreline of a large lake. Several features of the insect's morphology led Larson (1991*a*) to speculate that the beetle may burrow in sand along the margins of large northern lakes.

Distribution. Map 128. Known only from the type locality in southern Labrador.



Map 128. *Stictotarsus minipi* (Larson). Canadian and Alaskan collection localities.

2. *Stictotarsus spenceri* (Leech 1945)

Figs. 231; 109.

Deronectes spenceri Leech 1945b: 105. Type locality - 13 Mile Lake, Dog Creek Road, NW Clinton, British Columbia. Type in CNC, examined.

Selected References. Larson 1975: 318; Zimmerman and A. Smith 1975: 666 – 667; Daussin 1989: 251 – 252.

Description. Length = 5.4 to 6.4 mm; width = 2.6 to 3.0 mm; length: width = 1.94 to 2.10. Size large, shape elongate (Fig. 109A).

Body dorsally testaceous with darker maculations (Fig. 109A). Head testaceous except frons piceous along frontal fovea, mesad to each eye and behind eye; antennomeres 1 to 4 pale, outer antennomeres infuscate apically; palpi pale, apical palpomere of each palpus infuscate apically. Pronotum with anterior and posterior margins and a pair of triangular spots on disc, piceous to black. Elytron with sutural margin and eight elongate vittae piceous to black, vittae separate on most specimens but on some broadened and more or less fused laterally. Ventral surface mainly black. Legs pale with pro- and mesotarsi infuscate.

Disc of pronotum and elytron clothed with fine, golden setae. Head with dual punctation of numerous shallow umbilicate punctures and large sparse deep punctures

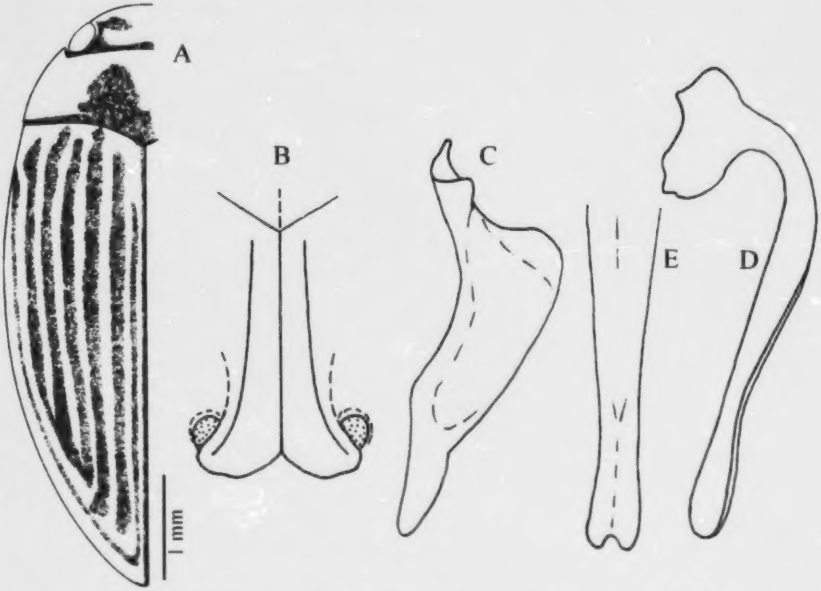


Fig. 109. *Stictotarsus spenceri* (Leech). A - left body outline, dorsal. B - metacoxal lines and processes. C - paramere. D - aedeagus, lateral. E - aedeagus apex, ventral.

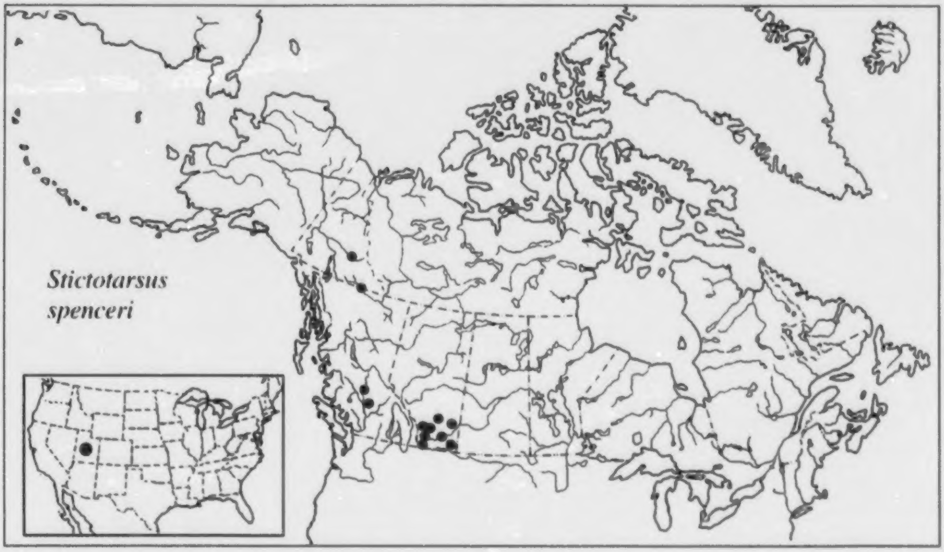
along frontal fovea and posterior margin of frons; interspaces finely reticulate. Pronotum and elytron with deep punctures smaller and denser than on head; interspaces with microreticulation finer. Ventral surface confluently punctate, appearing granulose. Metatrochanter and metafemora densely punctate; metatibia impunctate except for medial longitudinal row which contains many accessory setae basally.

Elytron with epipleuron visible to humeral angle in lateral aspect. Prosternal process narrow, sharply pointed, contacting metasternum and narrowly separating mesocoxae. Metacoxal lines (Figs. 23I; 109B) close, more or less parallel with interspace smooth except for coarse punctures adjacent to coxal lines, these punctures bearing elongate, erect, yellow setae.

Male metatrochanters ventrally and metafemur ventrally and posteriorly with long pale setae. Protarsal claws slightly elongate, anterior claw slightly broader and more arcuate than posterior. Sternum 6 concave medioapically, apex pointed and shortly deflected (female with similar modifications suggested or evident but not so well developed as in male). Aedeagus (Fig. 109D, E) more or less straight apically, apex broadened and narrowly emarginate, grooved dorsally.

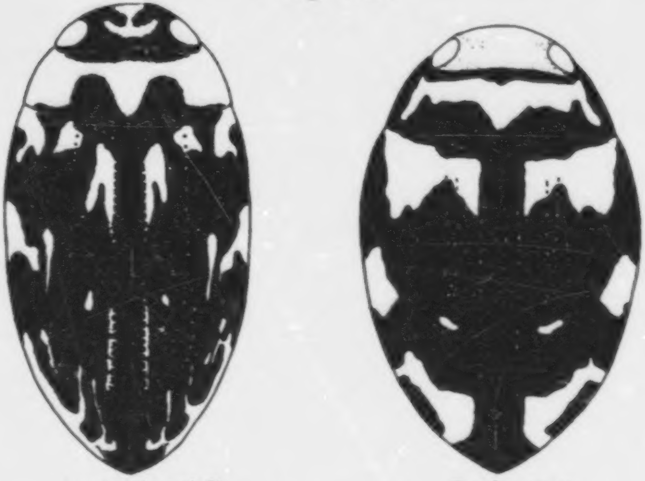
Ecology. Although single specimens have been collected from a variety of lentic habitats, all series have been found along the margins of permanent endorheic lakes. Some, but not all, of these lakes show distinct mineral enrichment or salinity. The beetles are usually over firm clay or sand substrates and generally among open emergent stands of *Juncus* or *Scirpus*.

Distribution. Map 129. The range includes the western Great Plains and intermontane valleys from Utah and Alberta to the southern Yukon Territory.



Map 129. *Stictotarsus spenceri* (Leech). Canadian and Alaskan collection localities and United States state records.

3. *Stictotarsus aequinoctialis* (Clark 1862)
Fig. 110A


A - *aequinoctialis*

B - *deceptus*

Fig. 110. *Stictotarsus aequinoctialis* (Clark) and *S. deceptus* (Fall). (From Zimmerman and A. Smith 1975).

Hydroporus aequinoctialis Clark 1862: 178. Type locality - Mexico.

Selected References. Zimmerman and A. Smith 1975: 663 – 666; Zimmerman 1982: 437.

Description. Length = 3.4 to 4.8 mm; width = 1.82 to 2.6 mm; length: width = 1.87 to 1.96. Body (Fig. 110A) oval, moderately elongate, lateral outline slightly discontinuous between pronotum and elytron.

Color of dorsal surface variegated with reddish-yellow and black markings (Fig. 110A). Head black except frontal bar, frons medially and clypeus, pale, these markings contiguous medially on many specimens; antennomeres 1 to 3 or 4 pale, outer antennomeres increasingly infuscate; palpi pale with apical palpomere of each palpus infuscate. Pronotum with anterior and posterior margins narrowly black, dark of posterior margin contiguous with a pair of large basomedial discal spots (these spots expanded and contiguous with dark anterior margin on some specimens); lateral bead infuscate basally. Elytron with dark longitudinal vittae but on most specimens these laterally confluent to produce a variegated pattern of isolated pale spots; epipleuron pale to piceous. Ventral surface mainly black except proepisternum paler. Legs dark rufous to piceous, with tarsi darker.

Pronotum and elytron densely punctate, punctures bearing very fine, short, pale setae. Interspaces between punctures shiny or with faint microreticulation. Ventral surface densely punctate. Metatrochanter and metafemur densely punctate; metatibia impunctate except for longitudinal row of setiferous punctures. Metatarsomere 1 dorsally with a longitudinal row of 5 to 7 erect setae near apex of mesal margin, adjacent to natatorial setae.

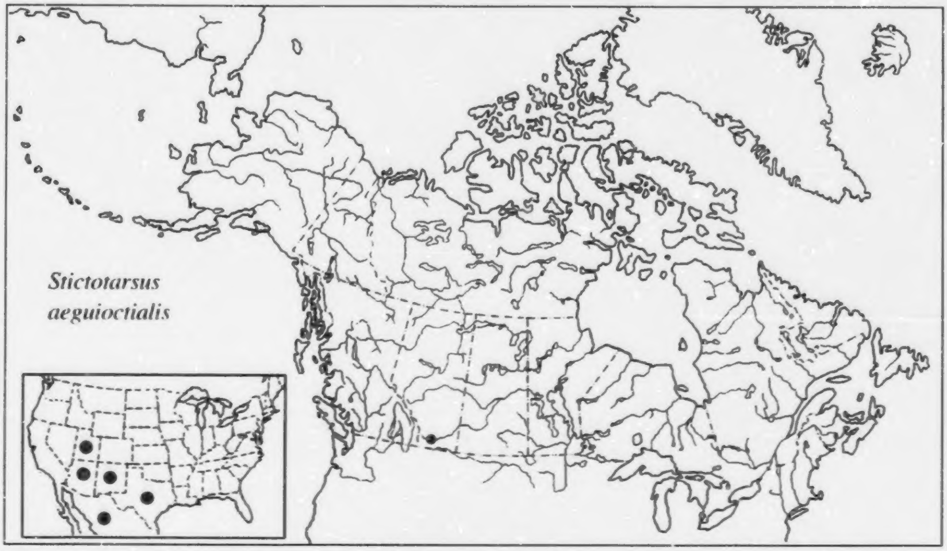
Pronotum with lateral margin evenly arcuate, in most specimens evidently discontinuous in outline with lateral margin of elytron; posterolateral angle distinct but obtuse; lateral bead narrow anteriorly, widening towards hind angle, elevated and sharply delimited from disc. Elytron disc with serial punctures well developed, some specimens with sutural and first two discal series of punctures in distinctly impressed grooves; in lateral aspect with lateral margin strongly arcuate and ascendant to humeral angle, epipleuron disappearing well posterad of shoulder. Prosternal prominence acute; process bluntly pointed, contacting metasternum and separating mesocoxae by a distance about one and one half times minimum width between procoxae. Metacoxa with lines diverging anteriorly, interlinear space densely punctate, with short sparse setae.

Male with protarsi slightly dilated, protarsal claws slightly elongate. Aedeagus small, evenly arcuate and tapered in lateral aspect, narrow and pointed in dorsal aspect.

Comments. Zimmerman and A. Smith (1975) indicated that this species was closely related to *S. griseostriatus* and that it was difficult to separate the two species in New Mexico. We have found that the dorsoapical row of setae on metatarsomere 1 of *S. aequinoctialis* provides a consistent character for their separation. The species *S. dolerosus* (Leech) and *S. funereus* (Crotch) also possess these setae. Although Zimmerman and Smith did not recognize a relationship between these species, they appear to form a natural group in which the members are parapatric across southwestern North America.

Ecology. Specimens have been collected from pools in small permanent and seasonal mountain streams where they occur on gravel and hard clay substrates.

Distribution. Map 130. This is primarily a species of southwestern North America, occurring in Mexico, western Texas, New Mexico, Arizona and southern Utah. We have seen a single specimen from Lethbridge, Alberta (13.V.1930, J. H. Pepper, CNC), taken with a series of *Nebrioporus macronychus*. The specimen was probably a vagrant for this region has been intensively collected without additional specimens turning up.



Map 130. *Stictotarsus aequinoctialis* (Clark).Canadian and Alaskan collection localities and United States state records.

4. *Stictotarsus striatellus* (LeConte 1852)

Fig. 111

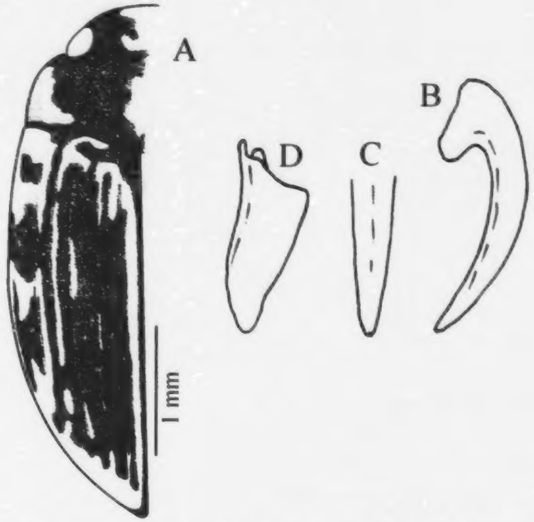


Fig. 111. *Stictotarsus striatellus* (LeConte). A - left body outline, dorsal. B - aedeagus, lateral. C - aedeagus apex, ventral. D - paramere.

Hydroporus striatellus LeConte 1852: 207. Type locality - "San Francisco and San Diego", California.

Selected references. Larson 1975: 315 — 316; Zimmerman and A. Smith 1975: 667 – 670; Zimmerman 1982: 436.

Description. Length = 3.8 to 4.7 mm; width = 2.0 to 2.5 mm; length: width = 1.76 to 1.92. Body (Fig. 111A) short, broadly oval.

Head black except a transverse fascia on posterior margin of frons and a small medial anterior spot (these fused on some specimens), rufous; clypeus pale on some specimens; antennomeres 1 to 3 or 4 yellow, outer antennomeres darkly infuscate; palpi testaceous, apical, and on some specimens penultimate, palpomere of each palpus infuscate apically. Pronotum with color various, some specimens entirely black, most specimens with pale spots situated post-medially and sublaterally. Elytron with color various, from almost entirely black (even darkest individuals with a testaceous spot at base mesad to shoulder) to lateral margin pale and disc with pale vittae, these variously broken and confluent; palest specimens with elytron more or less evenly testaceous to pale brown but at least sutural margin piceous; epipleuron testaceous to black. Ventral surface mainly piceous to black, proepisternum paler on many specimens. Legs piceous with apex of femora and tibia paler on most specimens.

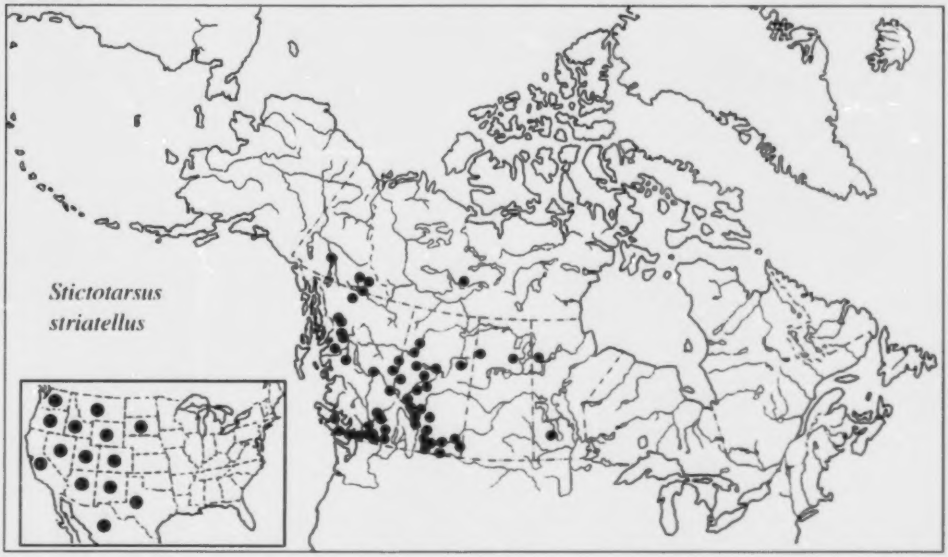
Dorsal surface of pronotum and elytron densely punctate, punctures bearing short adpressed greyish or yellow hairs (specimens with setae rubbed appear unusually dark). Head with more or less evenly spaced, irregularly sized, coarse punctures; interspaces coarsely reticulate. Pronotum medially with numerous small but deep setiferous punctures, interspaces shiny with sculpture more or less effaced. Elytron densely and more or less confluently punctate, interspaces shiny or with rudimentary sculpture. Ventral surface densely and confluently punctate. Metafemur with ventral face densely punctate medially, less densely so anteriorly; metatibia impunctate except for longitudinal row of setiferous punctures.

Head ventrally with a crease present behind posterior margin of eye. Pronotum short, broad, lateral curvature various from evenly rounded to almost straight; posterolateral angle obtuse; lateral bead narrow but well defined. Elytron short, broad, broadly rounded laterally, with an evidently impressed sutural stria and most specimens with one or two (some specimens with as many as five) longitudinal discal striae. Prosternal process narrow, with a narrow medial carina, its apex contacting metasternum and mesocoxae narrowly separated by a distance subequal to distance between procoxae. Metacoxal lines diverging anteriorly.

Male with protarsal claws slender and somewhat elongate but not conspicuously modified. Aedeagus (Fig. 111B, C) small, tapered to blunt point.

Ecology. The habitat is varied for specimens have been collected from spring-fed pools, beaver ponds, pools and quiet sections of small streams to large rivers, and the margins of alpine and subalpine lakes. The beetles often occur on fine organic silt bottoms into which they burrow, but have also been observed over sand, gravel and rock.

Distribution. Map 131. The species occurs throughout much of western North America from Manitoba to the Pacific and from central Mexico to the Yukon Territory.



Map 131. *Stictotarsus striatellus* (LeConte). Canadian and Alaskan collection localities and United States state records.

5. *Stictotarsus griseostriatus* (DeGeer 1774)

Figs. 23H; 112

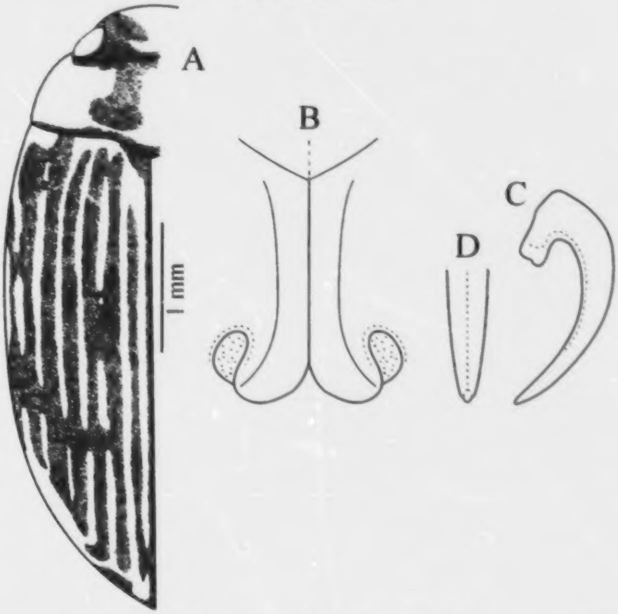


Fig. 112. *Stictotarsus griseostriatus* (DeGeer). A - left body outline, dorsal. B - metacoxal lines and processes. C - aedeagus, lateral. D - aedeagus apex, ventral.

Dytiscus griseostriatus DeGeer 1774: 403. Type locality - Sweden.

Selected References. Larson 1975: 316–317; Zimmerman and A. Smith 1975: 657–661; Hilsenhoff 1994: 292; Nilsson and Holmen 1995: 79 – 80.

Description. Length = 4.3 to 5.3 mm; width = 2.1 to 2.7 mm; length: width = 1.91 to 2.06. Body (Fig. 112A) elongate oval, lateral margin of pronotum and elytra more or less continuous.

Dorsal surface yellow with dark maculations (Fig. 112A). Head black except a transverse bar on frons between eyes and a triangular area on clypeus and anteromedial portion of frons, testaceous to bright rufous (these pale areas may be contiguous medially, sometimes broadly so); antenna yellow, antennomeres 5 to 11 infuscate; palpi yellow except terminal palpomere of each palpus infuscate. Pronotum with anterior and posterior margins narrowly piceous, disc with a pair of large piceous spots on basomedial portion (spots on most specimens contiguous with posterior margin, on some specimens spots enlarged and contiguous medially as well as extending anterad to front margin). Elytron variously maculate; palest specimens with sutural margin and seven or eight longitudinal dark vittae on disc; many specimens with vittae broadened and variously contiguous with pale areas restricted to humeral and lateral areas and several discontinuous longitudinal pale vittae, or some specimens with disc almost entirely piceous but at least lateral margin and epipleuron pale. Ventral surface mainly black, proepisternum yellow on some specimens. Legs rufous with tarsi and base of femora darkened.

Pronotum and elytra densely punctate, surfaces covered with short, decumbent, pale setae; interspaces with lightly impressed microreticulation but some specimens rather shiny. Ventral surface densely and contiguously punctate, surface appearing granular; metacoxae with intralinear space densely punctate, with short adpressed setae. Metatrochanter and metafemur densely punctate; metatibia impunctate except for medial row of setiferous punctures; metatarsomere 1 lacking dorso-apical row of setae.

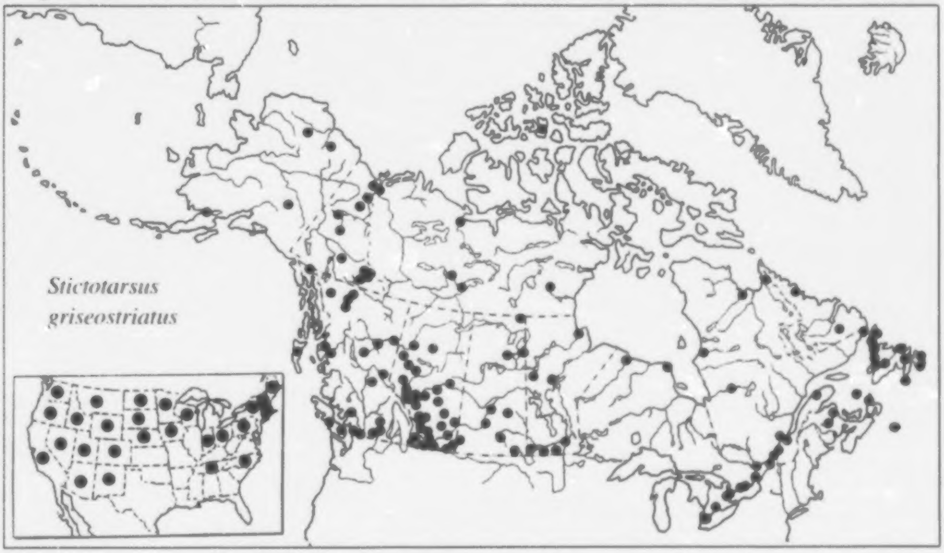
Pronotum with greatest width at prominent but slightly obtuse hind angles; lateral bead narrow, well defined. Elytron in lateral aspect slightly and broadly ascendant to humeral angle, epipleuron disappeared posterad of humeral angle. Prosternum with prominence various, obsolete to conspicuous; process sharply pointed, contacting metasternum and narrowly separating mesocoxae. Metacoxal lines (Fig. 112B) divergent anteriorly, interspace densely punctate with fine white setae (male) or largely smooth and shiny (female).

Male with protarsomeres 1 to 3 slightly broadened; protarsal claws slightly broadened and elongated. Sternum 6 not modified. Aedeagus (Fig. 112C, D) small, in dorsal aspect evenly narrowed to narrowly rounded apex, in lateral aspect more or less evenly arcuate and narrowed to apex.

Comments. This species shows a great deal of variation in size, body shape and color over its North American range. There is also subtle variation in the shape of the aedeagus, for example the aedeagus of specimens from coastal Oregon is narrower than that of specimens from other areas. It has been assumed that this variation is intraspecific but in Europe it has been demonstrated recently that *S. griseostriatus* consists of two cytospecies based on chromosome number and that these species can be recognized by subtle differences in the shape of the pronotum and width of the aedeagus (Nilsson and Holmen 1995). It is possible that a complex of species hides under this name in North America but it will require a very detailed study to settle this.

Ecology. *Stictotarsus griseostriatus* is a colonizing species. Specimens usually occur on mineral substrate in habitats where this is maintained by disturbance (e.g., gravel pits), erosion (wave washed shorelines of lakes, edges of pools in streams, pools adjacent to streams), or cold oligotrophic conditions (alpine lakes and ponds). They also occur in barren peat ponds, especially those that have eroding edges of bare, firm peat. Specimens may fly very early in the spring and have been found often in open water at the edges of rivers and lakes during the spring break-up period.

Distribution. Map 132. This species has a very wide Holarctic distribution. In the Palaearctic it extends from Britain to Kamchatka. The Nearctic range is from Newfoundland to the Aleutian Islands and from the low arctic south along mountain ranges to California, Arizona, and New Mexico in the west, and Tennessee in the east.



Map 132. *Stictotarsus griseostriatus* (DeGeer).Canadian and Alaskan collection localities and United States state records.

6. *Stictotarsus deceptus* (Fall 1932)

Fig. 110B

Hydroporus deceptus Fall 1932: 145. Type locality - Ojai, California.

Selected References. Zimmerman and A. Smith 1975: 692 – 696; Zimmerman 1982: 430.

Description. Length = 3.8 to 4.5 mm; width = 2.2 to 2.6 mm; length: width = 1.67. Body (Fig. 110B) rotund, oval; lateral margin continuous in dorsal aspect.

Body dorsally boldly marked with black and yellow maculations (Fig. 110B). Head dark with yellow triangular frontal spot and a transverse bar between eyes, these medially contiguous on most specimens; antenna yellow basally, darkly infuscate apically; palpi pale basally, apical palpomere of each palpus infuscate. Pronotum with anterior margin more or less evenly bordered with black, posterior margin more broadly darkened, dark areas expanded each side of middle and on some specimens contiguous with anterior black margin, lateral margin narrowly black or on some specimens fused with broadened dark band of hind margin; most specimens with a transverse pale bar on disc but on specimens with expanded marginal dark markings this may be restricted to a medial spot and a spot on each anteromedial portion of disc. Elytron black with contrasting pattern of yellow spots, largest spot subbasal, additional spots postmedially and subapically; epipleuron pale basally, infuscate apically. Ventral surface rufous to rufopiceous. Legs rufous.

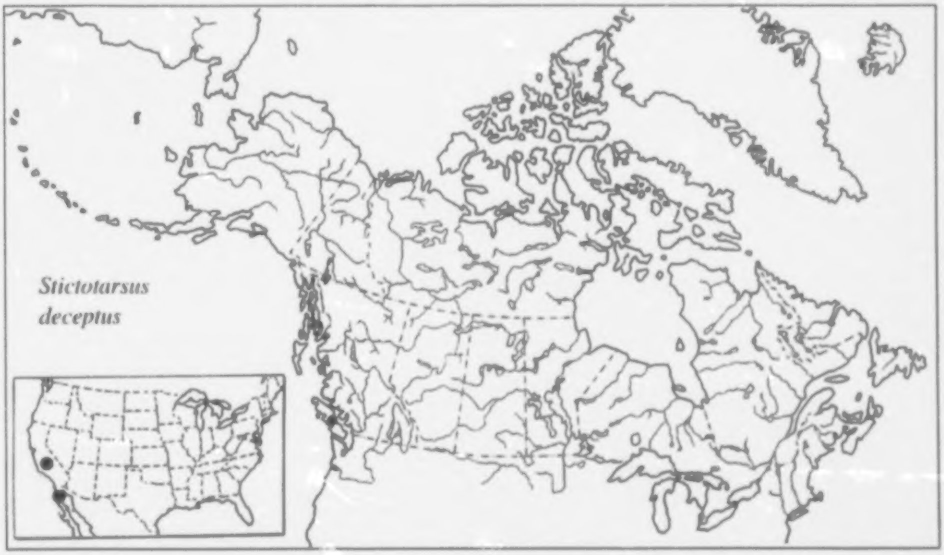
Dorsal surface glabrous. Pronotum with intermixed fine and coarse punctures; posterior portion with irregular longitudinal rugae. Elytron finely and densely punctate; interspaces shiny with at most obsolete reticulation

Head ventrally without a crease behind eye. Elytron without well developed striae; sutural series of punctures well developed, discal series less distinct, punctures confused and rows somewhat abbreviated; epipleuron broadly arcuate and slightly ascendant to humeral angle, epipleuron disappearing behind shoulder. Prosternum with prominence evident but low; process with a sharp medial carina, contacting metasternum and separating mesocoxae. Mesocoxae widely separated, distance between them almost twice minimum distance between procoxae. Metacoxal lines relatively widely separated and strongly diverging anteriorly. Metatarsomere 1 without dorsoapical row of setae.

Male protarsal claws not evidently modified. Aedeagus in dorsal aspect with a broad, rounded tip, spatulate.

Ecology. Zimmerman and A. Smith (1975) state that this is a mountain stream species.

Distribution. Map 133. The main part of the range is Baja California and California but Zimmerman and A. Smith (1975) reported a specimen from Vancouver Island.



Map 133. *Stictotarsus deceptus* (Fall). Canadian and Alaskan collection localities and United States state records.

Genus *Nebrioporus* Régimbart, 1906

Fig. 113

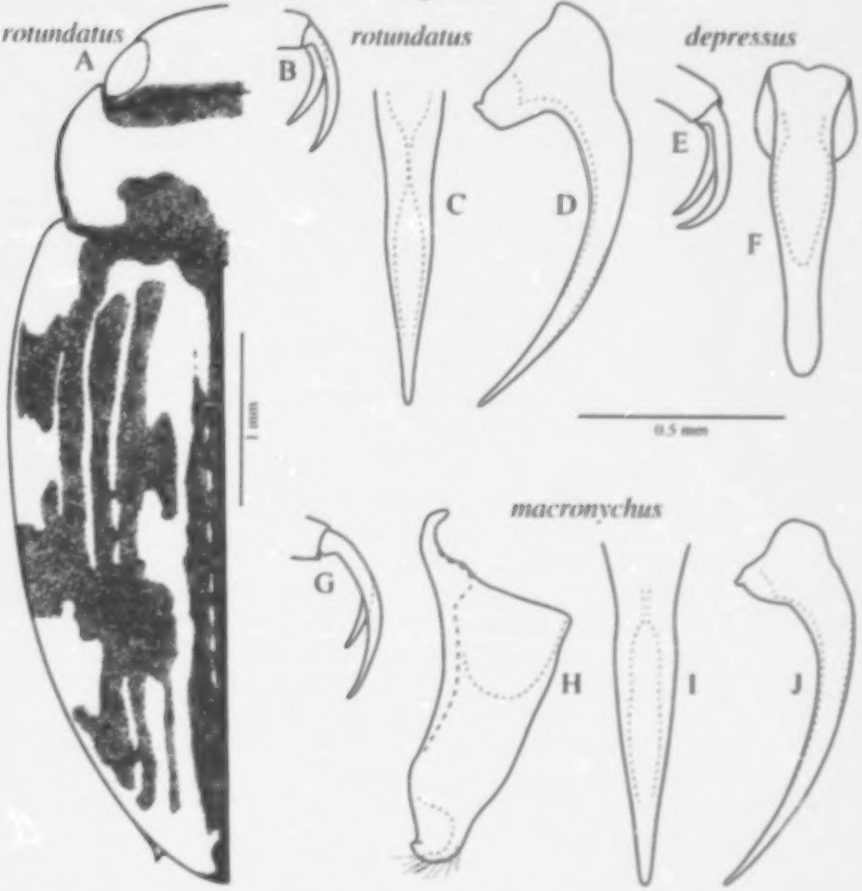


Fig. 113. *Nebrioporus*. A – D - *N. rotundatus* A - left body outline, dorsal. B - male protarsal claws, anterior. C - aedeagus apex, dorsal. D - aedeagus, lateral. E – F - *N. depressus*. E - male protarsal claws, anterior. F - aedeagus, dorsal. E – F - *N. macronychus*. G - male protarsal claws, anterior. H - paramere. I - aedeagus, dorsal. J - aedeagus, lateral.

Nebrioporus Régimbart 1906 : 237. Type species: *Hydroporus kilimandjarensis* Régimbart, by monotypy.

Potamonectes Zimmermann 1921: 87. Type species: *Dytiscus depressus* Frabricius, designated by Guignot 1941.

Hydroporus in part: Fall 1923, Larson 1975.

Deronectes in part: Zimmerman and A. Smith 1975.

Diagnosis. Length = 4.4 to 5.6 mm. Body elongate, pronotum narrowed basally or with hind angles broadly rounded so that lateral outline of body is strongly discontinuous (Fig. 113A).

Color testaceous to rufous with darker maculations; elytral maculations vittate; ventral surface reddish yellow to piceous.

Dorsal surfaces with fine, dense punctation, punctures bearing fine, adpressed, yellow setae. Ventral surface and metafemur densely punctate; metatibia with ventral face impunctate except for a longitudinal row of setiferous punctures.

Pronotum lacking sublateral longitudinal impressions; lateral bead narrow; posterolateral angle broadly rounded. Elytron without impressed longitudinal striae; lateral margin with a small, acute, subapical tooth; lateral margin in lateral aspect ascendant to humeral angle, epipleuron visible to base; epipleuron without a vertical carina on shoulder. Prosternum with file and prominence obsolete; prosternal process moderately broad and ovate, apex contacting anteromedial lobe of metasternum and narrowly separating mesocoxae. Metacoxal processes conjointly with hind margin medially emarginate, midline incised; interlaminar bridge hidden.

Male pro- and mesotarsomeres without enlarged adhesive scales on ventral surface. Paramere (Fig. 113H) apically with a sclerotized hook; aedeagus (Fig. 113D, F, J) simple, apex entire.

Comments. The genus *Nebrioporus*, as defined by Nilsson and Angus (1992), is rich in species in the Palaearctic and Ethiopian regions but is represented in the New World by only three species, one of which is Holarctic. The Nearctic species have been variously assigned to *Hydroporus* (Fall 1923; Larson 1975), *Deronectes* (Zimmerman and A. Smith 1975) or *Potamonectes* (Shirt and Angus 1992). Species definition in this group has been problematical because of hybridization of some species pairs. However, Shirt (Shirt 1983; Shirt and Angus 1992) in an exemplary study used breeding tests and electrophoretic analysis to elucidate the species limits within the *N. depressus* complex.

These insects occur on clay, sand or gravel substrates in small, slowly flowing streams or along the margins of lakes.

Key to species of *Nebrioporus* of North America

1. Aedeagus with apex broad in dorsal aspect (Fig. 113F); male protarsal claws subequal in length or anterior claw only slightly longer than posterior (Fig. 113E); low arctic and northern boreal region west of Hudson Bay .... 1. *N. depressus* (Fabricius)

1'. Aedeagus evenly tapered to a narrowly rounded apex (Fig. 113C, I); male anterior protarsal claw distinctly longer than posterior claw (Fig. 113B, G); transcontinental and generally more southerly distribution 2

2(1). Male protarsal claws very large, length of anterior claw 0.31 to 0.46 mm, 1.16 to 1.54 as long as posterior claw (Fig. 113G); Manitoba and west .... 2. *N. macronychus* (Shirt and Angus)

2'. Male protarsal claws shorter, length of anterior claw 0.25 to 0.37 mm, 1.03 to 1.33 as long as posterior claw (Fig. 113B); Western Ontario east to Atlantic Ocean ....3. *N. rotundatus* (LeConte)

1. *Nebrioporus depressus* (Fabricius 1775)

Fig. 113E, F

Dytiscus depressus Fabricius 1775: 233. Type locality - Sweden.

Selected References. Larson 1975: 315; Shirt and Angus 1992: 113.

Description. Length = 4.5 to 5.5 mm, width = 2.3 to 2.8 mm; length: width = 1.80 to 2.14. Elongate, pronotum with hind angles broadly obtuse and rounded, pronotum and elytra strongly discontinuous in outline.

Body testaceous to pale rufous with the following markings: head with posterior margin narrowly piceous or black; antenna with terminal 5 to 7 antennomeres infuscate apically; palpi each with apical palpomere darkly infuscate apically; pronotum with anterior and posterior margins lined with black, black of posterior margin contiguous with a pair of piceous spots on posterior third to half of disc; elytron with sutural margin and 6 or 7 longitudinal vittae, piceous or black (vittae may be variously expanded and coalescent but even darkest specimens with lateral margin, a basomedial area and several short longitudinal pale vittae). Ventral surface dark rufous to piceous. Legs rufous with tarsi infuscate.

Dorsal surface of body densely punctate, punctures of pronotum and elytron bearing short, dense, pale setae. Elytron with sculpture lightly impressed, shiny. Ventral surface densely punctate, sculpture more or less granular.

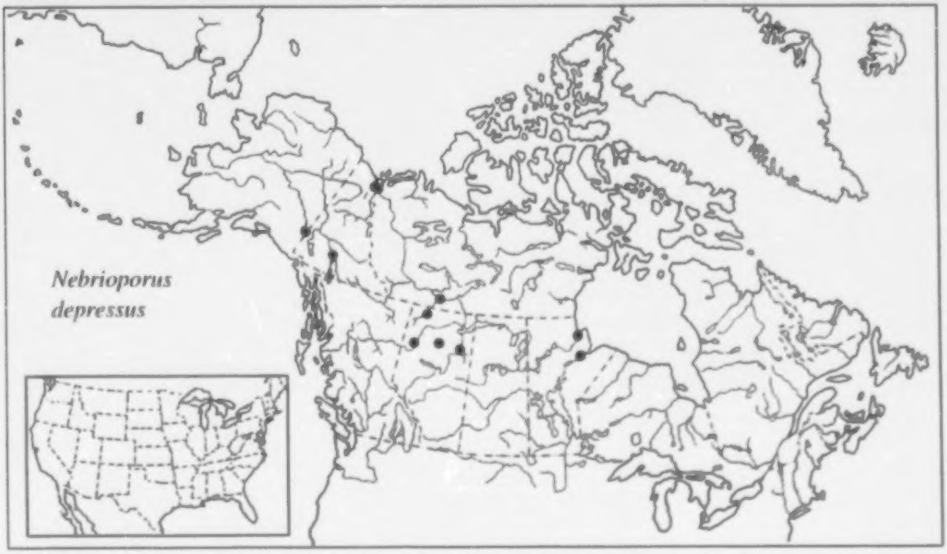
Pronotum broadly rounded laterally, with very obtuse hind angles; lateral bead narrow. Elytron with a small, acute, subapical marginal tooth. Prosternal process broad, slightly raised medially. Metacoxal lines divergent anteriorly.

Male with protarsomeres 1 to 3 dilated; anterior protarsal claw (Fig. 113E) elongate and broadened, parallel sided for basal two-thirds and strongly curved in apical third, subequal to or slightly longer than posterior claw which is narrower and more evenly curved. Aedeagus (Fig. 113F) in dorsal aspect with apex broad, spatulate; in lateral aspect tapered and decreasingly curved until apical fifth, then sinuate.

Comments. Shirt (1983) made a very careful study of the relationship between Palaearctic populations of *N. depressus* and *N. elegans* (Panzer 1794). He confirmed that these forms hybridize extensively in Britain and concluded that they are best treated as subspecies of one species, N. *depressus*. Shirt and Angus (1992) examined North American specimens and confirmed Larson's (1975) records of *N. depressus* in North America. Through breeding and morphometric analysis they demonstrated that *N. d. elegans* does not occur in North America, specimens so identified from the Great Plains and west (*H. elegans* sensu Larson 1975) represented an undescribed species, whereas those east of the Great Plains are assignable to *N. rotundatus* (LeConte). Zimmerman and A. Smith (1975) treated these three North American species as one, *Deronectes depressus*. Hilsenhoff (1994) found evidence of hybridization between *N. rotundatus* and *N. macronychus* in Wisconsin and recommended that they be regarded as subspecies of one widespread species. We follow Shirt and Angus (1992) in recognizing the two as separate species but recognize that a careful study of Manitoba and western Ontario populations should be undertaken to determine if hybridization occurs.

Ecology. Adults and larvae generally occur on mineral substrates such as clay, sand or fine gravel along the margins of lakes and small, slow streams.

Distribution. Map 134. This species has a Holarctic distribution. The subspecies *N. d. depressus* occurs from Britain, across northern Europe to Asia. In North America it is known from a few localities from northern Manitoba and northern Alberta to the Mackenzie Delta and eastern Alaska. The distribution is essentially boreal.



Map 134. *Nebrioporus depressus* (Fabricius). Canadian and Alaskan collection localities and United States state records.

2. *Nebrioporus macronychus* (Shirt and Angus 1992)

Fig. 113G – J

Potamonectes macronychus Shirt and Angus 1992: 120 – 123. Type locality - 3.5 mi N Champion, Alberta.

Selected References. Larson 1975: 314–315 (as *Hydroporus elegans*).

Description. Length = 4.5 to 5.6 mm; width = 2.3 to 3.0; length: width = 1.86 to 2.01. Body oblong-oval, lateral margins of pronotum and elytra strongly discontinuous in dorsal aspect.

Body yellow to pale rufous with dark maculations. Head with hind margin black; antenna yellow with antennomeres 5 or 6 to 11 increasingly infuscate apically; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum with anterior margin piceous to black, hind margin narrowly black and contiguous with a pair of dark spots on posterior third of disc. Elytron with sutural margin and seven or eight longitudinal discal vittae, piceous to black, coalescing slightly on some specimens and with interruptions forming up to six pale areas; lateral margin pale and contiguous with three or four of these pale areas. Ventral surface darker red to rufopiceous. Legs testaceous to rufous.

Body densely and finely punctate. Pronotum with disc granulate, with coarse and fine punctures.

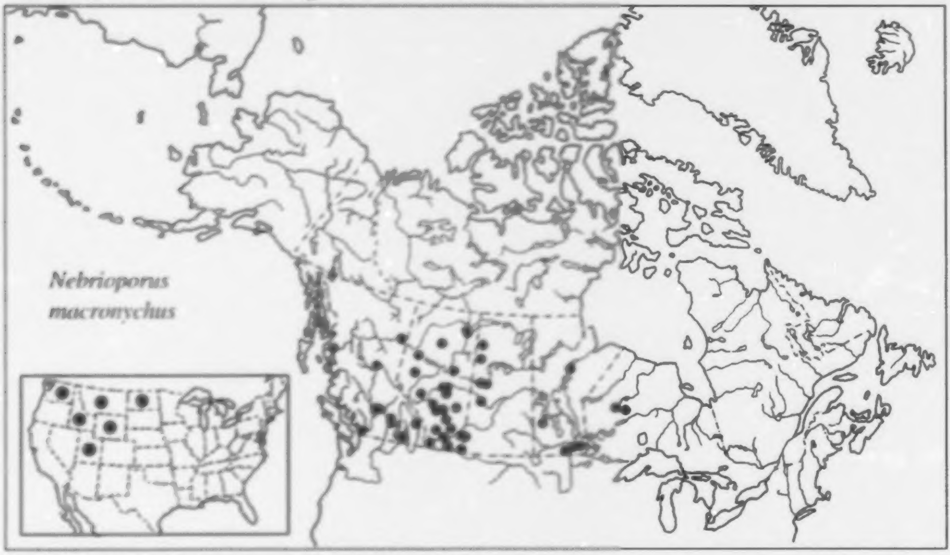
Pronotum broadly rounded laterally, posterolateral angle obtusely rounded; lateral bead narrow. Elytron with a small acute subapical lateral tooth.

Male protarsal claws (Fig. 113G) very elongate and broadened, anterior claw 0.33 to 0.46 mm and 1.16 to 1.54 times length of posterior claw; anterior claw flattened in cross-section, evenly but slightly arcuate along length, ending in a fine point; posterior claw narrower and more strongly arcuate. Aedeagus (Fig. 113I, J) in dorsal view evenly tapered to acute, narrowly rounded apex; in lateral aspect tapered and decreasingly curved to apex.

Comments. See comments under *N. depressus* and *N. rotundatus*.

Ecology. This species occurs on gravel, sand or hard clay bottoms of slow warm creeks and lake margins. Although not halophilic, specimens often occur in waters of some mineral enrichment.

Distribution. Map 135. The range extends from western Ontario to British Columbia and south to eastern Washington and northern Utah.



Map 135. *Nebrioporus macronychus* (Shirt). Canadian and Alaskan collection localities and United States state records.

3. *Nebrioporus rotundatus* (LeConte 1863)

Fig. 113A – D

Hydroporus rotundatus LeConte 1863: 21. Type locality - Toronto, Ontario.

Selected References. Shirt and Angus 1992: 118 – 120; Hilsenhoff 1994: 291 – 292.

Description. Length = 4.4 to 5.3 mm; width = 2.2 to 2.8 mm; length: width = 1.82 to 2.06. Body (Fig. 113A) elongate-oval, lateral margins of pronotum and elytra sharply discontinuous.

Body with ground color reddish yellow. Head with hind margin narrowly black; antenna yellow with antennomeres progressively infuscate apically; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum with anterior margin broadly piceous; hind margin narrowly black and contiguous with a pair of piceous spots on posterior half of disc. Elytron with sutural margin and seven or eight longitudinal vitae, black, vittae extensively coalescing and with interruptions forming six pale areas including the apex; lateral margin pale, narrow and contiguous with four of these pale areas. Ventral surface darker reddish. Legs reddish.

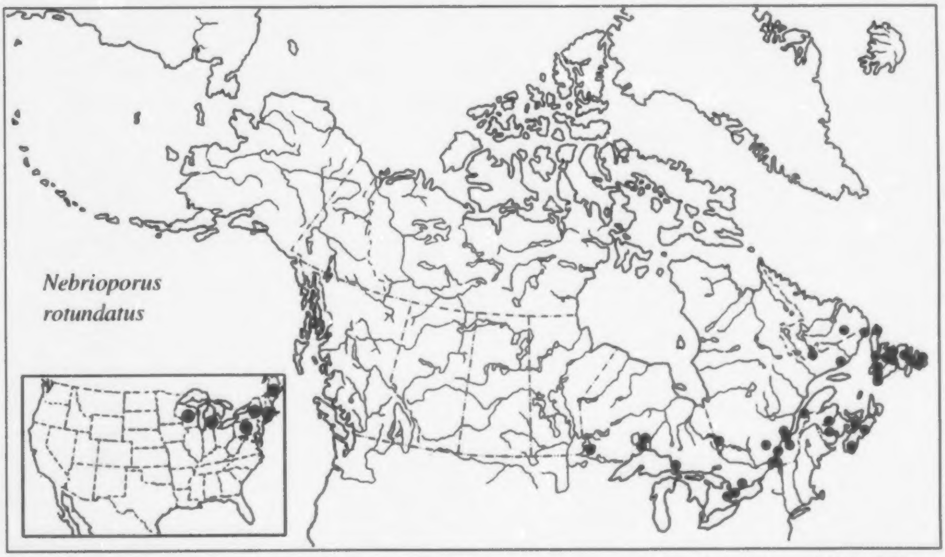
Body densely punctate. Head and pronotum somewhat dull, elytra more shining. Pronotum with disc granulate, with coarse and fine punctures.

Pronotum broadly rounded laterally, posterolateral angle obtusely rounded; lateral bead narrow. Elytron with a small acute subapical lateral tooth.

Male with anterior protarsal claw about 1.15X as long as posterior claw (Fig. 113B), posterior claw narrower and more strongly arcuate. Aedeagus (Fig. 113C, D) in dorsal aspect evenly tapered to acute, narrowly rounded apex; in lateral aspect tapered and decreasingly curved to apex. Parameres lightly sclerotized and tapering apically.

Comments. Hilsenhoff (1994) demonstrated that Wisconsin specimens are intermediate in diagnostic characters between the western *N. macronychus* and the eastern *N. rotundatus* and suggested that the two should be treated as subspecies of *N. rotundatus*. We treat the two forms as separate species but recognize the need for a careful study of variation within the complex.

Ecology. The species occurs in similar habitats to those of the other members of the genus. In Newfoundland, specimens have been collected from freshwater portions of barachois ponds (ponds at the mouth of streams cut off from the sea by gravel bars, subject to infrequent seawater incursion or at least wave splash and spray salt enrichment).



Map 136. ***Nebrioporus rotundatus*** **(LeConte). Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 136. The distribution extends from Newfoundland to western Ontario and Wisconsin and south into the northeastern United Sates.

Genus *Oreodytes* Seidlitz 1887

Figs. 23G; 114 – 121

Oreodytes Seidlitz 1887: 57. Type species: *Hyphydrus borealis* Gyllenhal (= *Dytiscus alpinus* Paykull), designated by F. Balfour-Browne 1936 (Nilsson and Holmen 1995).

Diagnosis. Size small to moderate, length = 2.8 to 5.4 mm; body shape various, short and broadly oval (Fig. 120A) to rather elongate and parallel-sided (Fig. 118A); lateral outline continuous or not.

Color pale dorsally with head and disc of pronotum variously maculate, elytra with longitudinal vittae but on some specimens vittae may be expanded and fused to produce a spotted pattern; ventral surface mainly black.

Punctation and sculpture various, setae of dorsal surface very short and inconspicuous; ventral surface with at least some large clearly separated punctures on metacoxal plates; metafemur with ventral face not densely punctate, but separated setiferous punctures may be present over much of ventral face.

Pronotum with a sublateral longitudinal impression or crease on each side of disc (Fig. 114A, 115A, 116A); lateral bead narrow. Elytron with lateral margin not toothed or some specimens with a rectangular to obtuse subapical tooth (Fig. 118A, B); lateral margin in lateral aspect ascendant to humeral angle, epipleuron visible to base (Fig. 115B) or not (Fig. 119B); epipleuron without a humeral carina. Prosternal process with file and prominence obsolete; blade rather broad, lowly convex, contacting anteromedial lobe of metasternum. Metacoxal processes (Fig. 23G) conjointly with hind margin incised along medial line (produced along medial line in *O. quadrimaculatus* Horn (Fig. 114B)). Metafemur with dorsal margin distinctly separated from metacoxal lobe by trochanter (Fig. 23G).

Male protarsi generally little modified, protarsomere 1 with two pairs of large rounded adhesive setae on ventral surface; protarsal claws not or only slightly modified. Paramere with a subapical membranous sac or excavation (Fig. 115E, 116D); aedeagus simple, apex pointed.

Comments. Zimmerman (1985) revised the North American species of the genus although subsequently Larson (1990*b)* and Alarie (1993) recognized additional species in northwestern North America. The genus contains species of two quite different body forms, namely large, elongate species and small, rounded species. However, species of intermediate size and shape occur supporting inclusion of both forms within one genus. The species *O. quadrimaculatus* is peculiar in several features, especially structure of the metacoxal process, and possibly does not belong in this clade. Zimmerman (1985) postulated that it was sister to the clade containing the other members of *Oreodytes* and retained it in *Oreodytes* rather than creating a "new, weakly differentiated genus".

The species are either lotic or occur along the exposed shorelines of cold lakes. All species occur on mineral substrates. Larson (1985) found distribution patterns indicating ecological segregation amongst Alberta species. Zack (1992) has described the habitats of species occurring in the Pacific Northwest states.

Key to species of *Oreodytes* of North America

1. Metacoxal processes conjointly with hind margin incised medially along medial line Fig. 23G); size and shape various but if body broadly ovate (length: width less than 1.80) then length less than 3.4 mm; elytron with color pattern various but not dark with a large humeral, subapical and apical pale spots; female sternum 6 without a narrow apically setose lobe 2

1'. Metacoxal processes conjointly with hind margin produced posteriorly along median line so that its apex lies more posterad than lateral angles of process (Fig. 114B); body broadly ovate, length: width = 1.70 to 1.78; length = 3.5 to 4.0 mm; elytron dark with a humeral, a subapical and an apical pale spot (Fig. 114A); female sternum 6 produced medially as a narrow, apically setose lobe (Fig. 114C) . . . . .1. *O. quadrimaculatus* (Horn)

2. Body short and broad (Figs. 120A; 121A, E, F) , length: width = 1.6 to 1.8; size small, length = 2.5 to 3.3 mm 9

2'. Body more elongate (Figs. 115A; 116A), length: width = 1.85 to 2.14; size larger, length greater than 3.2 mm 3

3(2). Elytron with epipleuron visible to humeral angle when viewed in lateral aspect (Fig. 115B) 4

3'. Epipleuron hidden behind lateral margin of elytron for a short distance behind humeral angle (Fig. 119B) . . . . 7. *O. scitulus* (LeConte)

4(3). Protibia strongly dilated in apical half, inner margin sinuate; epipleuron piceous to black 5

4'. Protibia evenly broadened towards apex, inner margin more or less straight; epipleuron yellow or at most lightly infuscate 7

5(4). Male abdomen inflated in lateral aspect, in same plane or below that of metasternum; sternum 5 with at least a small posteromedial lobe; aedeagus in dorsal aspect widened subapically and spoon-shaped (Fig. 117E, F); female sternum 6 with hind margin distinctly lobed medially (Fig. 117C, H); female with subapical tooth of elytron various (Fig. 117A, B, G) 6

5'. Body more depressed, male abdomen not conspicuously inflated in lateral aspect; sternum 5 lacking medioapical lobe; aedeagus in dorsal aspect more or less parallel sided or narrowed towards apex, in lateral aspect subangularly broadened subapically (Fig. 118D, E); female sternum 6 with hind margin broadly rounded, not distinctly lobed medially (Fig. 118C); female elytron with subapical tooth present or absent, if present, apex distad of tooth oblique (Fig. 118A, B) . . . . 6. *O. recticollis* (Fall)

6(5). Male aedeagus moderately widened subapically, its maximum width not less than 2X its medial width (Fig. 117E); female elytron with subapical tooth obtuse, hind margin mesad of tooth forming an angle of much less than 90° with sutural angle (Fig. 117A, B) . . . . 4. *O. alaskanus* (Fall)

6'. Male aedeagus strongly widened subapically, its maximum width 2 or more times it medial width (Fig. 117J); female elytron with subapical tooth more or less right angled, hind margin mesad to tooth forming approximately a right angle with sutural margin (Fig. 117G, H) . . . . 5. *O. productotruncatus* (Hatch)

7(4). Base of pronotum as broad as or broader than elytra across humeral angles (Fig. 115A); female elytron without subapical tooth; length = 3.4 to 3.9 mm; elytral maculations brown to piceous, not black . . . . 2. *O. snoqualmie* (Hatch)

7'. Pronotum narrower at base than elytra across humeral angles on most specimens (Fig. 116A); female elytron with a lateral subapical tooth; length = 4.1 to 5.1 mm; elytral maculations piceous to black 8

8(7). Elytron densely and conspicuously punctate; northwest California . . . . *O. humboltensis* Zimmerman 1985

8'. Elytron with punctation fine, punctures small and inconspicuous; widely distributed . . . . 3. *O. laevis* (Fall)

9(2). Elytron aside from usual serial punctures virtually impunctate or with punctures minute and inconspicuous 10

9'. Elytron with disc between rows of serial punctures evidently punctate 12

10(9). Metatrochanter with hind margin relatively densely punctate and setose; body more elongate, length: width = 1.60 to 1.83; ratio metafemur length: metatrochanter length = 2.39 to 2.71 mm; arctic and northern boreal . . . . 9. *O. sanmarkii* (Sahlberg)

10'. Metatrochanter with hind margin sparsely setose; body more ovate, length: width = 1.52 to 1.77; ratio length metafemur: length metatrochanter = 2.00 to 2.32; western montane, north to central Yukon Territory 11

11(10). Elytron with dark vittae originating near basal margin, most specimens with vittae 1 to 4 more or less distinct and not fused (Fig. 120A); metacoxal plate mesally with conspicuous punctures, laterally punctures smaller and shallower . . . . 8. *O. obesus* (LeConte)

11'. Elytron with brown or piceous vittae originating well posterad of basal margin, vittae 1 to 4 more or less fused basally (Fig. 121A); metacoxal plate with conspicuous punctures more or less evenly distributed over surface . . . . 10. *O. congruus* (LeConte)

12(9). Metacoxal lines slightly divergent anteriorly; pronotum with discal maculations consisting of two transverse lines (Fig. 122A); size small, length = 2.8 to 3.0 mm .12. *O. angustior* (Hatch)

12.' Metacoxal lines strongly divergent anteriorly; pronotum with discal markings various but not consisting of a pair of transverse lines; size various, many specimens greater than 3.0 mm 13

13(12). Elytron with a subsutural series of punctures; many specimens with an additional two to four shallow discal sulci 14

13'. Elytron without subsutural series of punctures or distinct elytral sulci 15

14(13). Elytron with a broad discal maculation apparently formed by coalescence of abbreviated longitudinal vittae; pronotum diffusely darkened medially; northern California, western Oregon and Washington . . . . *O. subrotundus* (Fall 1923)

14'. Elytron and pronotum lacking definite pattern of darker markings; northeastern California . . . .*O. sierrae* Zimmerman 1985

15(13). Elytron reddish brown, without well defined maculations; northwestern California . . . . *O. rhyacophilus* Zimmerman 1985

15'. Elytron with well defined maculations, generally in the form of longitudinal vittae, spots or a sharply delimited medial cloud 16

16(15). Pronotum with lateral bead swollen on posterolateral angle; metasternum medially flattened but not separated by a distinct crease from lateral areas . . . . .11. *O. crassulus* (Fall)

16'. Pronotum with lateral bead of uniform width throughout its length; metasternum with medial area clearly separated from lateral areas by a distinct crease or ridge 17

17(16). Pronotum with disc dark medially, lateral margins broadly pale; metasternum medially shallowly depressed and coarsely punctate; elytron in lateral aspect with lateral margin strongly ascending to humeral angle; Washington, Oregon, California . . . . *O. abbreviatus* (Fall 1923)

17'. Pronotum with disc pale medially and mediolaterally, dark maculations along and adjacent to anterior and basal margins (Fig. 122E); metasternum medially deeply impressed, not coarsely punctate; elytron with lateral margin not strongly ascendant to humeral angle . . . . 13. *O. picturatus* (Horn)

1. *Oreodytes quadrimaculatus* (Horn 1883)

Fig. 114

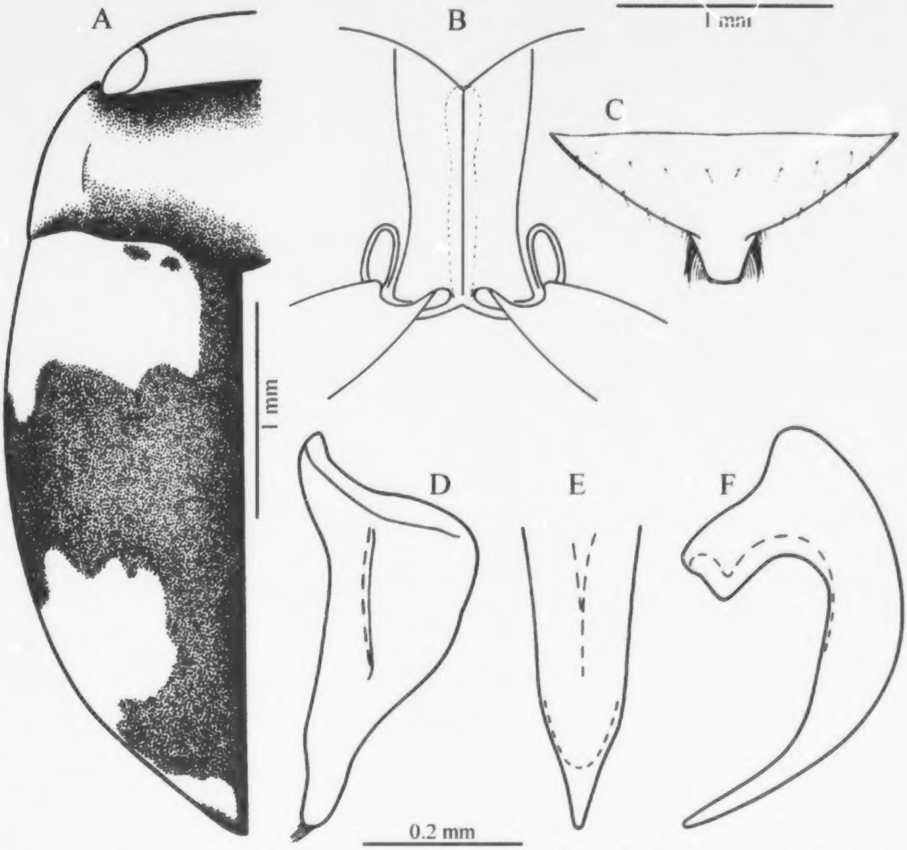


Fig. 114. *Oreodytes quadrimaculatus*. A - left body outline, dorsal. B - metacoxal processes. C - female sternum 6, ventral. D - paramere. E - aedeagus apex, ventral. F - aedeagus, lateral.

Hydroporus quadrimaculatus Horn 1883: 284. Type locality - western Nevada.

Selected References. Larson 1975: 318 – 319; Zimmerman 1985: 122 – 123; Alarie 1997: 408 – 410.

Description. Length = 3.5 to 4.0; width = 2.1 to 2.3 mm; length: width = 1.70 to 1.76. Body (Fig. 114A) ovate, lateral margin of pronotum and elytron more or less continuous.

Head rufotestaceous; antenna and palpi testaceous, without apical infuscation. Pronotal disc rufous; basal and apical margins broadly piceous, lateral border narrowly piceous on some specimens. Elytron dark brown to piceous except lateral margin, large humeral spots on basal third, slightly smaller subapical spot, and a small apical spot, pale rufous; epipleuron testaceous. Ventral surface dark rufous with metasternal wings, metacoxal plates and basolateral areas of abdominal sterna, piceous. Legs rufous.

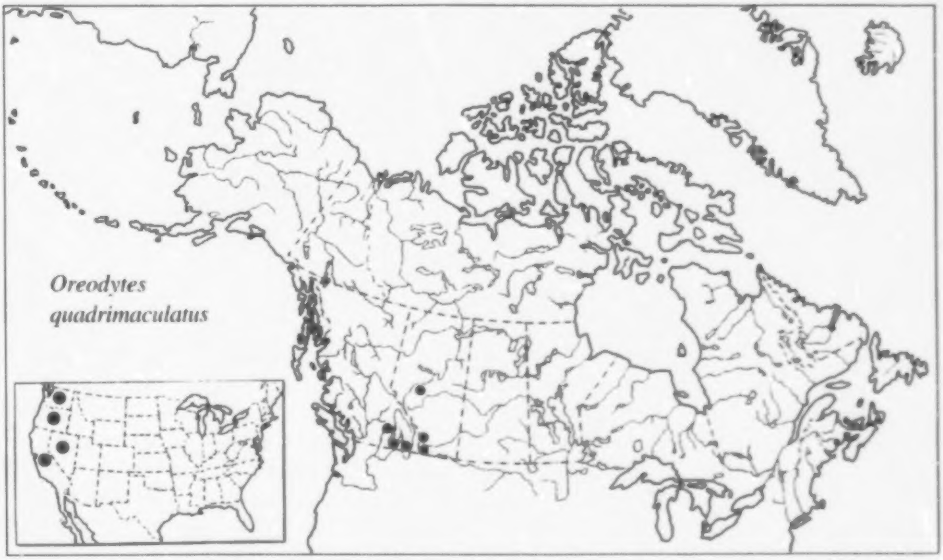
Dorsal surface glabrous. Elytron with shallow, large punctures basally, obsolete laterally and apically; interspaces with numerous micropunctures located at intersections of lines of very fine microreticulation. Metacoxal plate with a few large irregularly situated punctures; ventral surface including epipleuron, densely micropunctate.

Pronotum with posterolateral angle somewhat produced behind, acute; lateral bead well defined, narrowed towards front angle; disc mediolaterally with longitudinal groove lightly impressed; base broadly and slightly produced medially. Prosternum without prominence and file; process short, broad, more or less flat with a slight medial longitudinal convexity. Metacoxal processes (Fig. 114B) with hind margin conjointly sinuate, excavated each side of middle and median line produced posteriorly so that its apex lies more posterad than lateral angles of processes; metacoxal lines slightly divergent anteriorly, interspace densely punctate, glabrous. Epipleuron visible to humeral angle in lateral aspect. Metafemur with small, sparse punctures, without linear arrangement of medioventral punctures. Metatibia with a group of erect setae on inner apical margin, best developed on male. Male sternum 6 unmodified; female sternum 6 (Fig. 114C) produced posteromedially into narrow, apically rounded lobe, its posterior margin fringed with short setae.

Male with protarsomeres 1 to 3 slightly dilated, protarsomere 1 with four round adhesive scales beneath; protarsal claws relatively long and slender but otherwise unmodified. Sternum 6 unmodified. Aedeagus (Fig. 114E, F) robust basally, relatively short.

Comments. The systematic position of this peculiar species is discussed under the comments for the genus above, and more extensively by Zimmerman (1985).

Ecology. This is a lotic species, occurring in small, clear streams. Although poorly collected, the typical habitat appears to be low gradient streams which have sand and gravel substrates and good pool and riffle development. The beetles occur in areas of



Map 137. *Oreodytes quadrimaculatus* (Horn). Canadian and Alaskan collection localities and United States state records.

light to strong current, amongst roots and debris of undercut banks. F. Carr collected this species from Beaver Creek, southwest Alberta, in the 1920's. However, subsequent collecting has not turned up recent specimens. Like many streams in southwestern Alberta, the banks of Beaver Creek have been broken down and the stream has become quite silty due to overstocking of cattle and this habitat change may have eliminated the species. The larva has been described by Alarie (1997).

Distribution. Map 137. The range extends from western Alberta and southern British Columbia to Nevada and California. However within this range the species is very local and known from only a few localities.

2. *Oreodytes snoqualmie* (Hatch 1933)

Fig. 115

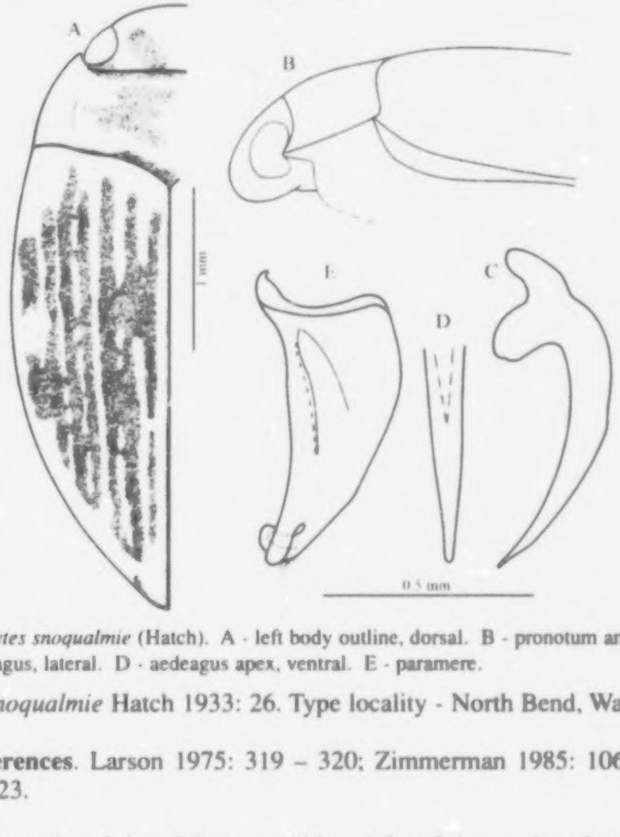


Fig. 115. *Oreodytes snoqualmie* (Hatch). A - left body outline, dorsal. B - pronotum and elytral base, lateral. C - aedeagus, lateral. D - aedeagus apex, ventral. E - paramere.

Hydroporus snoqualmie Hatch 1933: 26. Type locality - North Bend, Washington.

Selected References. Larson 1975: 319 – 320; Zimmerman 1985: 106 – 107; Alarie 1997: 422 – 423.

Description. Length = 3.4 to 3.8 mm; width = 1.8 to 2.1 mm; length: width = 1.79 to 1.91. Body (Fig. 115A) elongate-oval, pronotum of most specimens wider near base than elytra across shoulders therefore lateral outline slightly discontinuous in dorsal aspect.

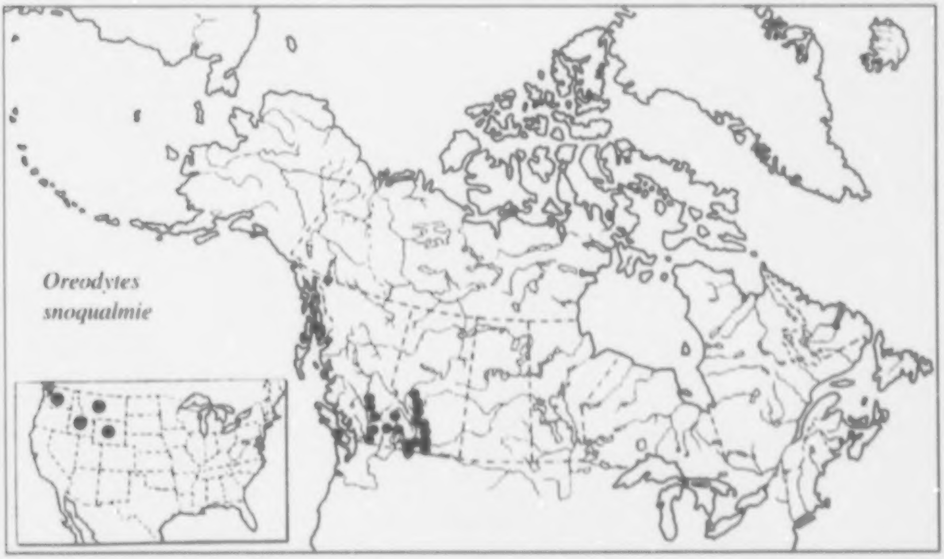
Color of dorsal surface pale brown. Head with an elongate spot mesad to each eye, spots produced and confluent posteromedially; area posterad to each eye piceous; antenna with antennomeres 1 to 3 or 4 testaceous, outer antennomeres progressively infuscate; palpi testaceous with apical palpomere of each palpus infuscate apically. Pronotum with anterior and posterior margins narrowly brown to piceous; disc with two transverse maculations, each narrowly broken medially on most specimens but longitudinally confluent on many specimens. Elytron with sutural margin narrowly darkened; disc with five or six discal vittae (may be more or less confluent on some specimens) and two or three spots laterad to these; color of vittae various, brown on most specimens but also pale brown and barely contrasting with ground color to piceous or very rarely black; epipleuron testaceous to piceous. Ventral surface brown to piceous or black.

Punctation various; elytron very densely micropunctate, otherwise some specimens almost impunctate dorsally, others with conspicuous dorsal punctures. Metacoxal plates with sculpture coarse and obscuring shallow punctures.

Pronotum at widest point wider than elytra across base; sides broadly and evenly rounded, constricted shortly before hind angle; hind angle various, ranging from produced and more or less acute to narrowly rounded and slightly obtuse; lateral bead narrow, weakly delimited from disc. Elytron broadly rounded laterally with maximum width about middle, without a subapical tooth on female; epipleuron visible to humeral angle in lateral aspect (Fig. 115B). Metacoxal lines evenly and gradually divergent; metacoxal processes conjointly with hind margin incised medially. Protibia evenly widened towards apex, margins not or only slightly sinuate. Metatarsomere 1 with internal apical angle produced.

Male anterior protarsal claw not modified; protarsomeres 1 to 3 slightly widened, protarsomere 1 with four small oval scales on ventral surface. Aedeagus (Fig. 115C, D) well sclerotized, apex in lateral aspect narrowed and slightly sinuate apically; paramere (Fig. 115E) relatively broad.

Ecology. Larson (1975) reported this species from the margins of subalpine lakes in the Alberta Rocky Mountains as well as from clear, cool, mountain rivers. The larva has been described by Alarie (1997).



Map 138. *Oreodytes snoqualmie* (Hatch). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 138. This species is known from western Alberta, southern British Columbia and adjacent northwestern states.

3. *Oreodytes laevis* (Kirby 1837)

Fig. 116

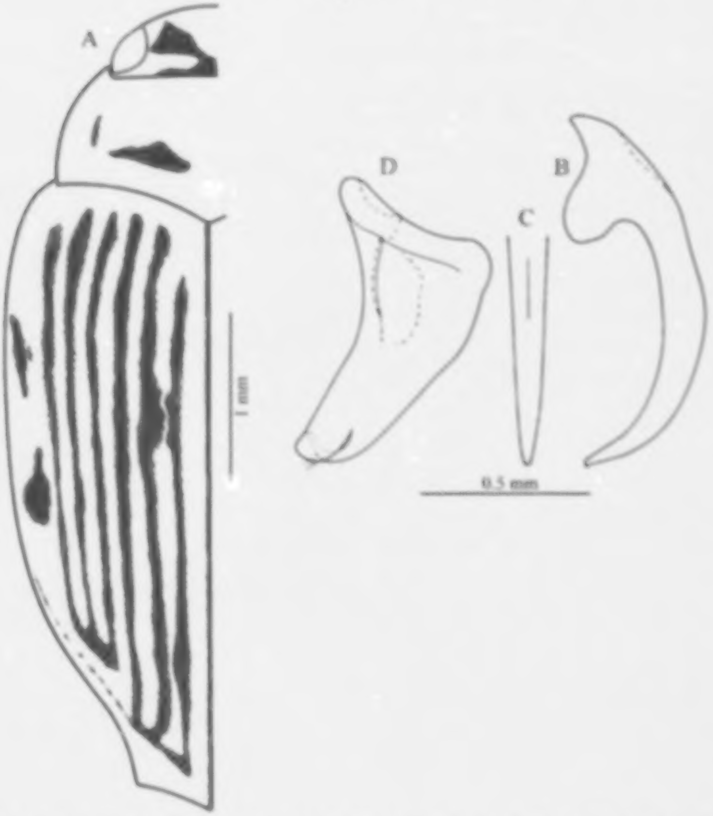


Fig. 116. *Oreodytes laevis* (Kirby). A - female left body outline, dorsal. B - aedeagus, lateral. C - aedeagus apex, ventral. D - paramere.

Hydroporus laevis Kirby 1837: 67. Type locality - Boreal America.

Selected References. Larson 1975: 320; Zimmerman 1985: 107; Alarie 1997: 420 – 422.

Description. Length = 4.1 to 5.1 mm; width = 2.1 to 2.5 mm; length: width = 1.89 to 2.09. Body (Fig. 116A) elongate oval, pronotum narrower at base than elytra across humeri therefore body discontinuous in outline in dorsal aspect.

Dorsal surface of body pale yellow to testaceous with the following darker markings: a pair of posteriorly contiguous spots on frons between eyes; pronotal disc with a pair of transverse spots (may be confluent medially on some specimens) on basal third which extend laterally to about level of sublateral longitudinal impressions which are also pigmented; elytron with sutural margin and six longitudinal discal vittae and two sublateral spots (vittae may be variously broken or laterally contiguous). Ventral surface piceous to black. Legs yellow, variously infuscate.

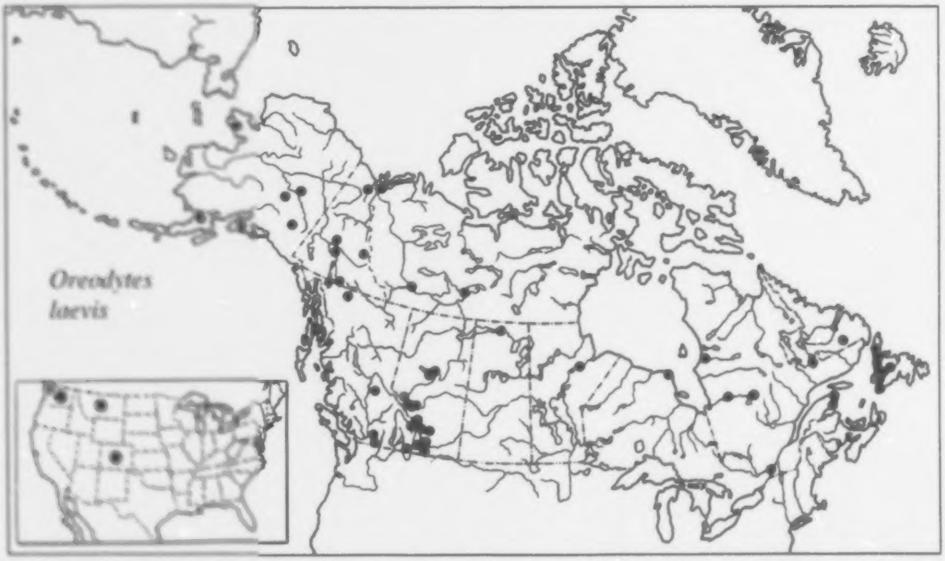
Elytron with lateral margin strongly ascendant to humeral angle in lateral aspect, epipleuron visible to shoulder; female elytron with a subapical lateral tooth of varied shape, from sharp and acute to rather bluntly pointed, elytral apex mesad of tooth sinuate (Fig. 116A). Protibia gradually and evenly broadened from base to apex, inner margin more or less straight. Metacoxal lines divergent. Metatarsomere 1 with inner apical angle strongly produced. Abdomen not inflated or expanded below plane of metasternum in lateral aspect; sterna not modified on male; female sternum 6 broadly transversely impressed, ventral margin concave in lateral aspect.

Male pro- and mesotarsomeres 1 each with four small oval scales on ventral surface; protarsal claws slightly longer and broader than mesotarsal claws. Aedeagus (Fig. 116B, C) elongate, evenly tapering to narrow apex which is slightly expanded and narrowly truncated.

Comments. Nilsson and Holmen (1995) and Alarie (1997) noted that both adults and larval stages of *O. laevis* are very similar to those of the Palaearctic *O. alpinus* (Paykull). However, adults are not identical and are probably specifically distinct. For example, there is a difference in habitus for in lateral aspect the metacoxae are somewhat recessed relative to the plane of the metasternum and abdominal sterna in *O. alpinus*, whereas the coxae are relatively more projecting in *O. laevis*.

Ecology. This species occurs in rock pools, gravel pits, pools along rivers, exposed lake shores and along quiet margins of streams. The beetles are generally in sites with few or no macrophytes and with mineral substrates. The larva has been described by Alarie (1997).

Distribution. Map 139. The range extends from Newfoundland to Alaska and south along the Rocky Mountains to Colorado.



Map 139. *Oreodytes laevis* (Kirby). Canadian and Alaskan collection localities and United States state records.

4. *Oreodytes alaskanus* (Fall 1926)

Fig. 117A – F

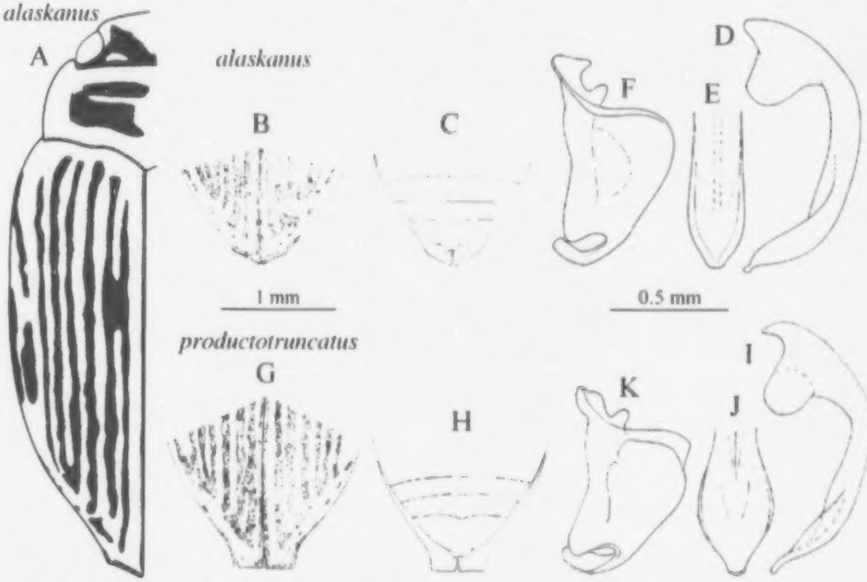


Fig. 117. *Oreodytes*. A – F - *O. alaskanus* A - female left body outline, dorsal. B - female elytral apex. C - female abdomen apex, ventral. D - aedeagus, lateral. E - aedeagus apex, ventral. G – K - *O. productotruncatus*. G - female elytral apex. H - female abdomen apex, ventral. I - aedeagus, lateral. J - aedeagus apex, ventral. K - paramere.

Hydroporus alaskanus Fall 1926: 139. Type locality - Skagway, Alaska.

Selected References. Zimmerman 1985: 110 – 112; Alarie 1993: 859 – 862; Alarie 1997: 426 – 427.

Description. Length = 4.6 to 5.4 mm; width = 2.2 to 2.6 mm; length: width = 2.03 to 2.14. Body (Fig. 117A) elongate, pronotum slightly narrower at base than elytra across humeri therefore outline of body somewhat discontinuous in dorsal aspect.

Dorsal surface testaceous with the following darker markings (Fig. 117A): head with an inverted V on frons contacting inner margin of eyes and posterior margins of eyes and head; pronotum with anterior and posterior margins narrowly margined, disc with a pair of transverse fasciae (each may be broken along midline to form two transverse spots), fasciae connected laterally along darkened sublateral longitudinal impressions; elytron with sutural margin and seven or eight longitudinal discal vittae (vittae may be variously expanded and connected); epipleuron dark. Ventral surface mainly black. Antenna with basal 4 or 5 antennomeres yellow, antennomeres 5 or 6 to 11 increasingly infuscate apically. Legs testaceous, femora basally and tarsi variously infuscate.

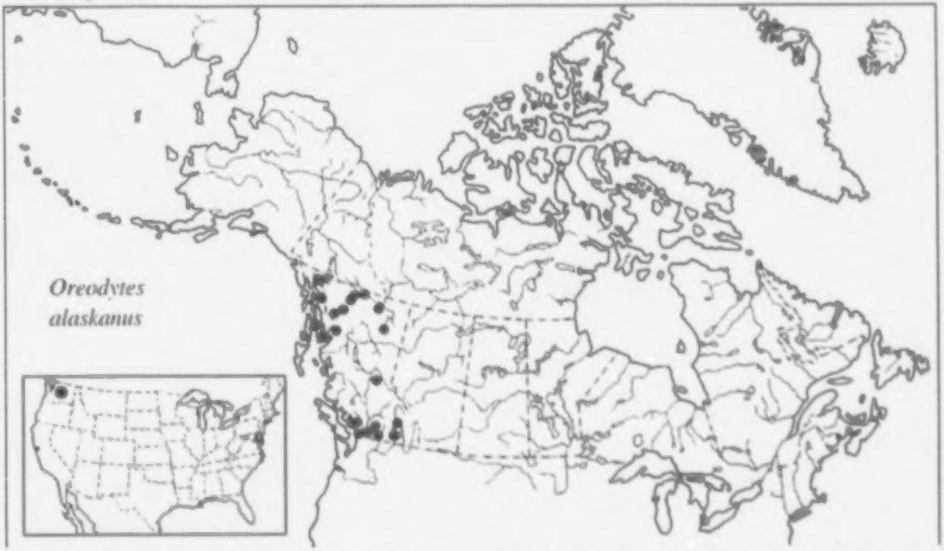
Body sparsely to moderately punctate, male usually more shiny than female.

Pronotum with lateral margin rounded in anterior half, more or less straight or slightly sinuate towards base; hind angle right or slightly acute. Elytra elongate, subparallel basally, lateral margin strongly ascendent to humeral angle and epipleuron visible to shoulder in lateral aspect; male with elytral apex rounded; female elytron (Fig. 117A, B) with or without a subapical tooth, where developed, tooth obtuse and hind margin oblique and forming an angle of less than 90° with sutural angle. Metacoxal lines subparallel to slightly divergent. Male abdomen inflated ventrally, extended below plane of metasternum in lateral aspect; sternum 5 slightly lobed medially; sternum 6 flattened medially. Female abdomen (Fig. 117C) not inflated and not extending below plane of metacoxa; sternum 4 without a posteromedial lobe; sternum 5 with posteromedial lobe small or absent; sternum 6 in ventral aspect with apex narrowly produced and apically truncate, in posterior aspect deeply U-shaped. Protibia broadly expanded in distal half, inner margin strongly arcuate, outer margin more or less straight. Metatarsomere 1 with inner apical angle not or only slightly produced.

Male aedeagus (Fig. 117D, E) laterally expanded towards apex, spoon-shaped.

Ecology. Specimens have been found in clear, cool pools and ponds with gravel substrates. They also occur in quiet pools of small streams. The larva has been described by Alarie (1997).

Distribution. Map 140. The range extends from southern Alaska to Alberta and Washington.



Map 140. *Oreodytes alaskanus* (Fall). Canadian and Alaskan collection localities and United States state records.

5. *Oreodytes productotruncatus* (Hatch 1944)

Fig. 117G – K

Hydroporus productotruncatus Hatch 1994: 46. Type locality - Fairmont, British Columbia

Hydroporus alaskanus: Larson 1975: 321

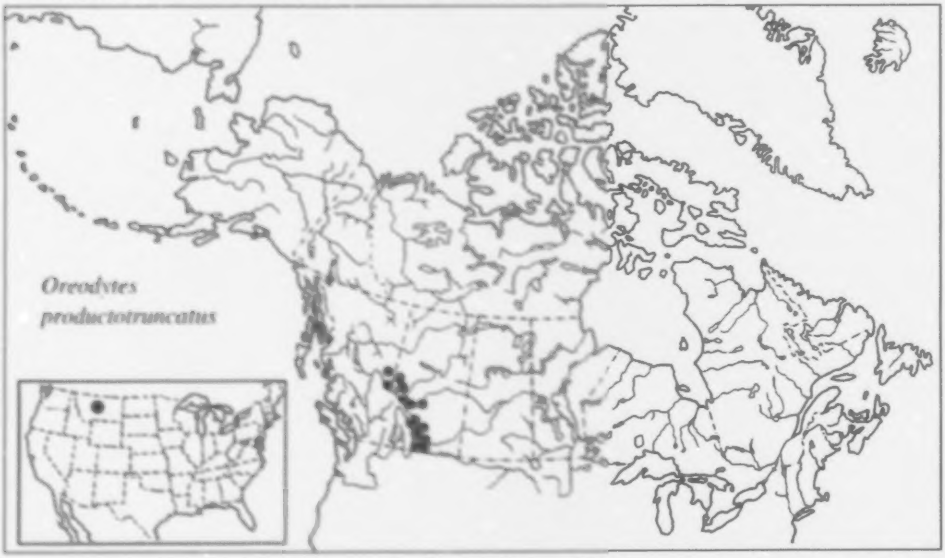
Selected References. Larson 1975: 321 (as *Hydroporus alaskanus*); Zimmerman 1985: 110 (in part); Alarie 1993: 862 – 864; Alarie 1997: 425 – 426.

Description. Length = 4.8 to 5.4 mm; width = 2.3 to 2.6 mm; length: width = 2.03 to 2.14. Similar in habitus to *O. alaskanus*.

Similar to *O. alaskanus* in color pattern, differing as follows: maculation pattern blackish; basal 3 or 4 antennomeres yellow, distal antennomeres increasingly infuscate apically. Body sparsely to moderately punctate; male usually more shiny than female. Male with abdomen distinctly inflated and extending ventrally below medial plane of metasternum; sternum 5 with a small posteromedial lobe, sternum 6 with posterior margin broadly lobed medially. Female elytron (Fig. 117G) with a more or less right angled subapical lateral tooth, hind margin of elytron mesad of tooth making a right angle with sutural margin; female sternum 6 with an apical lobe (Fig. 117H). Male aedeagus (Fig. 117I, J) in dorsal aspect broadly expanded subapically, width across widest part 2 or more times medial width.

Ecology. These beetles occur on mineral substrates such as sand and gravel in cool clear pools such as gravel-pit pools, pools adjacent to stream channels, and in quiet pools of small streams. The larva has been described by Alarie (1997).

Distribution. Map 141. This species occurs in the Rocky Mountains of western Alberta, southeastern British Columbia and western Montana.



Map 141. *Oreodytes productotruncatus* (Hatch). Canadian and Alaskan collection localities and United States state records.

6. *Oreodytes recticollis* (Fall 1926)
Fig. 118

Hydroporus recticollis Fall 1926: 140. Type locality - Seward, Alaska.

Oreodytes leechi Zimmerman 1985: 110. Type locality - Mile Post 86, Glenn Highway, Alaska.

Selected References. Zimmerman 1985: 110; Alarie 1993: 864 – 865; Alarie 1997: 423 – 425.

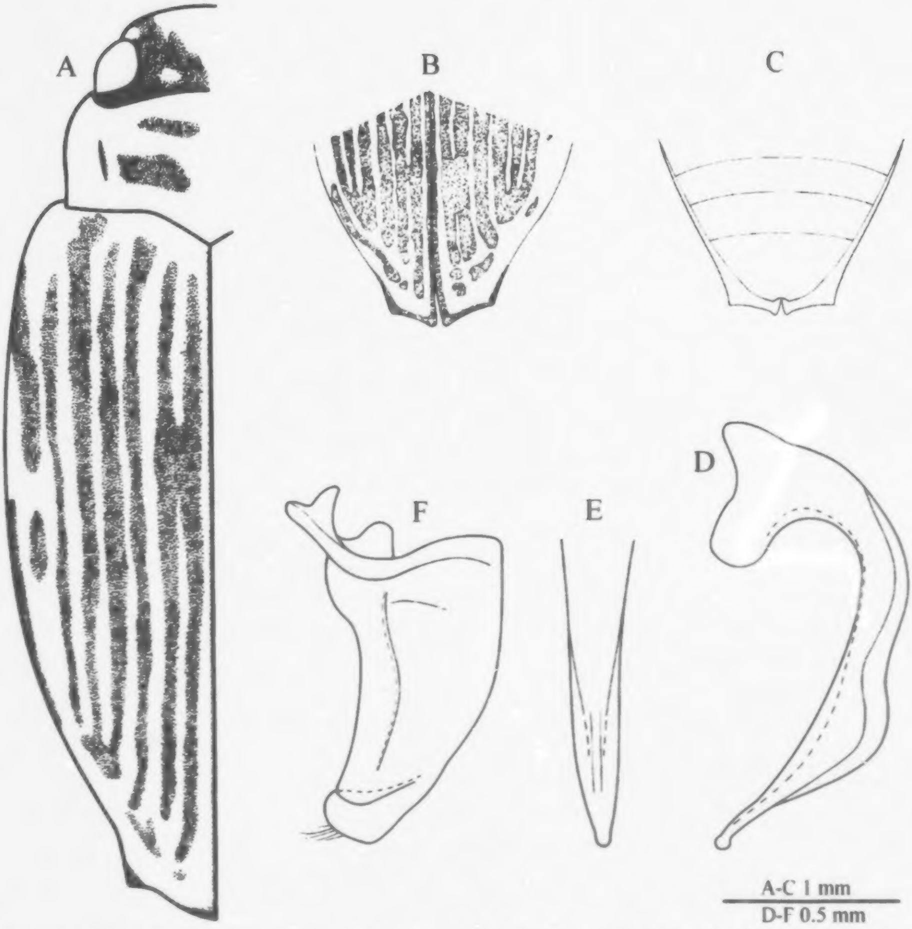


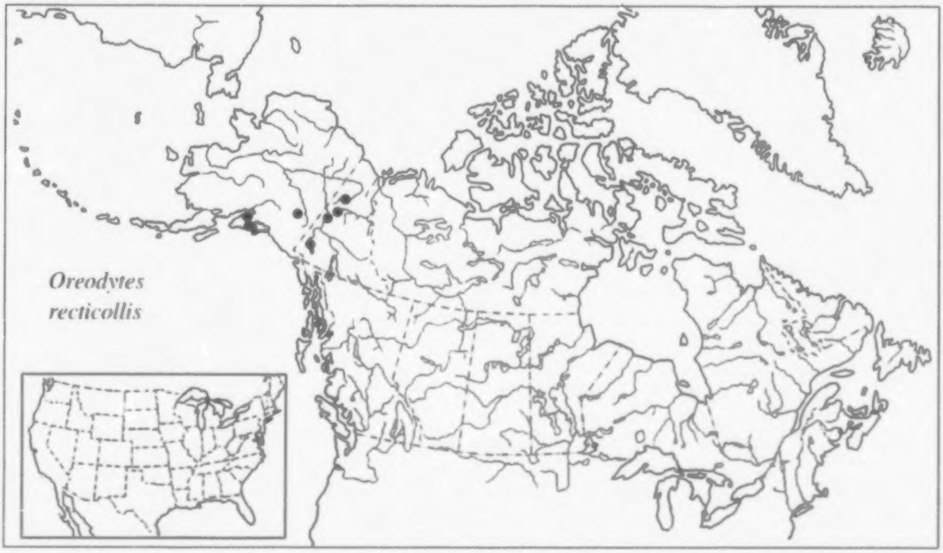
Fig. 118. *Oreodytes recticollis* (Fall). A - female, left body outline, dorsal. B - female, elytral apex. C - female, abdomen apex, ventral. D - aedeagus, lateral. E - aedeagus apex, ventral. F - paramere.

Description. Length = 4.7 to 5.3 mm; width = 2.1 to 2.4; length: width = 2.15 to 2.24. Body (Fig. 118A) elongate, parallel sided.

Similar to *O. alaskanus*, differing as follows: color pattern as in Fig. 118A, maculations more brownish than black, antenna with antennomeres 1 to 3 or 4 yellow, distal antennomeres increasingly infuscate apically; body very sparsely punctate, some specimens almost impunctate, male and female equally shiny; body more depressed, male abdomen not evidently inflated, sterna 4 and 5 not lobed posteromedially; elytron of female (Fig. 118A, B) with subapical tooth blunt or absent, apex of elytron mesad of tooth forming an acute angle with sutural margin; female abdominal sternum 6 (Fig. 118C) more broadly rounded apically, apex slightly and broadly emarginate in ventral aspect, deeply U-shaped in posterior aspect; male aedeagus (Fig. 118D, E) not laterally expanded or spoon-shaped subapically but with dorsal margin broadly angular subapically.

Ecology. Habitat not described. Label data indicated some paratypes of *O. leechi* were collected from a roadside pool. The larva has been described by Alarie (1997).

Distribution. Map 142. The species is known from southeastern Alaska and western Yukon Territory.



Map 142. *Oreodytes recticollis* (Fall). Canadian and Alaskan collection localities and United States state records.

7. *Oreodytes scitulus* (LeConte 1855)

Fig. 119

Hydroporus scitulus LeConte 1855: 295. Type locality - Eagle Harbor, Lake Superior.

Selected References. Larson 1975: 322 – 323; Zimmerman 1985: 104 – 106; Hilsenhoff 1994: 290; Alarie 1997: 418 – 420.

Description. Length - 3.2 to 4.0 mm; width = 1.7 to 2.1 mm; length: width = 1.86 to 1.94. Body (Fig. 119A) elongate-oval, pronotum with lateral margin more arcuate than base of elytra therefore body outline slightly discontinuous.

Color pattern as in Fig. 119A. Ground color of dorsal surface testaceous to pale brown. Head with a longitudinal piceous spot mesad to each eye, spots parallel and not convergent posteriorly on frons; margin of eye and posterior margin of head, narrowly piceous; antenna testaceous, antennomeres 5 to 11 infuscate apically; palpi testaceous with terminal palpomere of each palpus infuscate apically. Pronotum with anterior and posterior margins narrowly piceous, disc with two transverse fasciae, on many specimens continuous with each other along sublateral impressions. Elytron with sutural margin and about eight longitudinal vittae, piceous to black; vittae 1 to 5 distinct, outer three vittae irregular, fused or broken on many specimens; epipleuron piceous, paler inside humeral angle. Ventral surface piceous to black. Legs pale with base of femora, apex of tibia and tarsomeres variously infuscate.

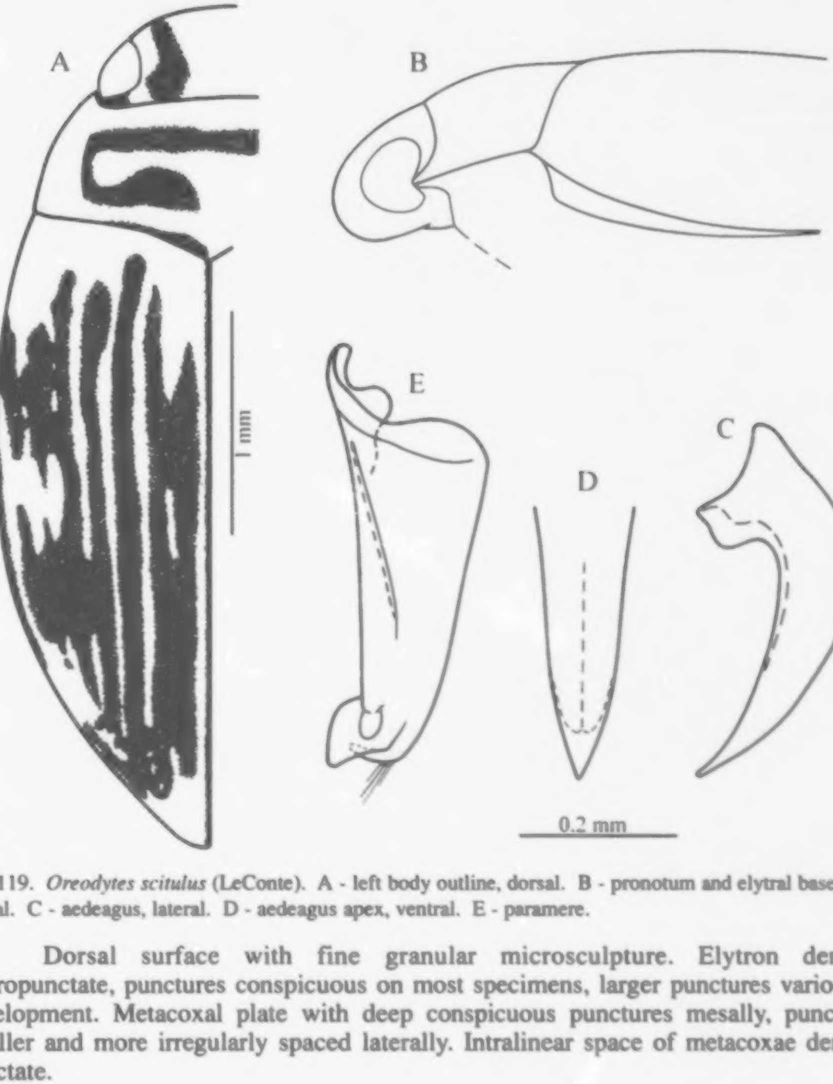


Fig. 119. *Oreodytes scitulus* (LeConte). A - left body outline, dorsal. B - pronotum and elytral base, lateral. C - aedeagus, lateral. D - aedeagus apex, ventral. E - paramere.

Dorsal surface with fine granular microsculpture. Elytron densely micropunctate, punctures conspicuous on most specimens, larger punctures various in development. Metacoxal plate with deep conspicuous punctures mesally, punctures smaller and more irregularly spaced laterally. Intralinear space of metacoxae densely punctate.

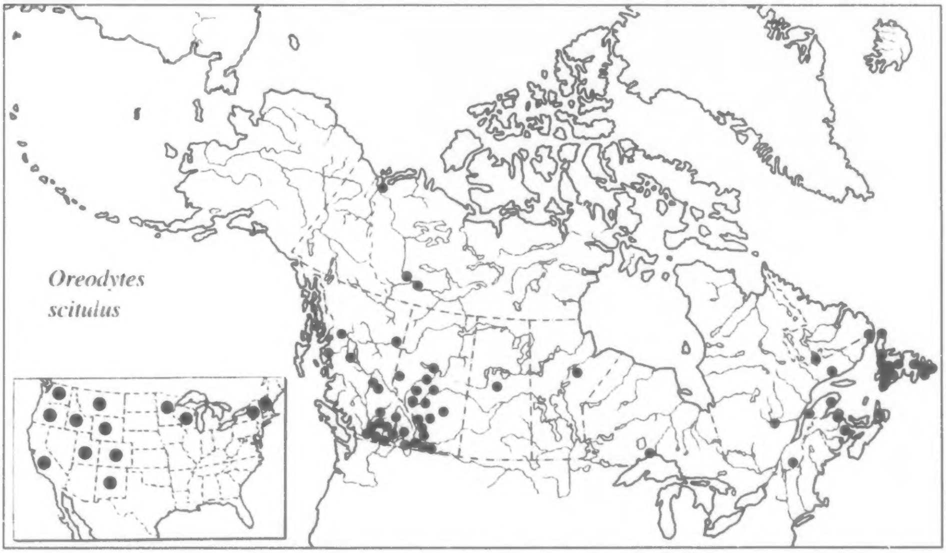
Pronotum with sides evenly rounded, about as wide as elytra across base but with posterolateral angle obtuse and slightly discontinuous with curvature of elytra; lateral bead very fine, shallowly delimited from disc. Prosternum without prominence and file. Epipleuron in lateral aspect disappearing behind lateral margin of elytron posterior to humeral angle (Fig. 119B). Metacoxal lines slightly divergent anteriorly; processes conjointly with hind margin incised medially. Abdominal sterna not modified. Protibia evenly widened towards apex.

Male with anterior protarsal claw unmodified; protarsomeres slightly dilated, protarsomere 1 with four small ventral scales. Aedeagus (Fig. 119C, D) short, slightly arcuate, evenly tapering to pointed apex.

Comments. Several authors have pointed out the similarity between Nearctic *O. scitulus* and the Palaearctic *O. septentrionalis* (Gyllenhal). Larson (1975) noted a minor difference in aedeagus shape between an English specimen and Alberta specimens. Alarie (1997) did not find any difference between the larvae. This complex requires careful study to resolve the status of the two taxa. Within North America, Zimmerman (1985) recognized two subspecies: *O. s. bisulcatus* (Fall 1923: 115) in northwestern California, and *O. s. scitulus* from the rest of the range.

Ecology. These insects occur in medium to large streams and along the wave-washed margins of lakes. They are more tolerant of warm water and silt than are other species of the genus and thus are found in lower sections of drainage systems as well as having a wider continental distribution. Alarie (1977) described the larva.

Distribution. Map 143. This species occurs across northern North America, from Newfoundland and New York to British Columbia and California.



Map 143. *Oreodytes scitulus* (LeConte). Canadian and Alaskan collection localities and United States state records.

8. *Oreodytes obesus* (LeConte 1866)

Fig. 120A – D

Hydroporus obesus LeConte 1866: 365. Type locality - California.

Oreodytes obesus cordillerensis Larson 1990b: 301–302. Type locality - Liard River, Upper Liard, Yukon Territory.

Selected Reference. Zimmerman 1985: 112–115; Larson 1990*b*: 295 – 303; Alarie 1997: 437 – 439.

Description. Length 2.8 to 3.2 mm; width = 1.7 to 1.9 mm; length: width = 1.61 to 1.72. Body (Fig. 120A) short and broad, subglobose.

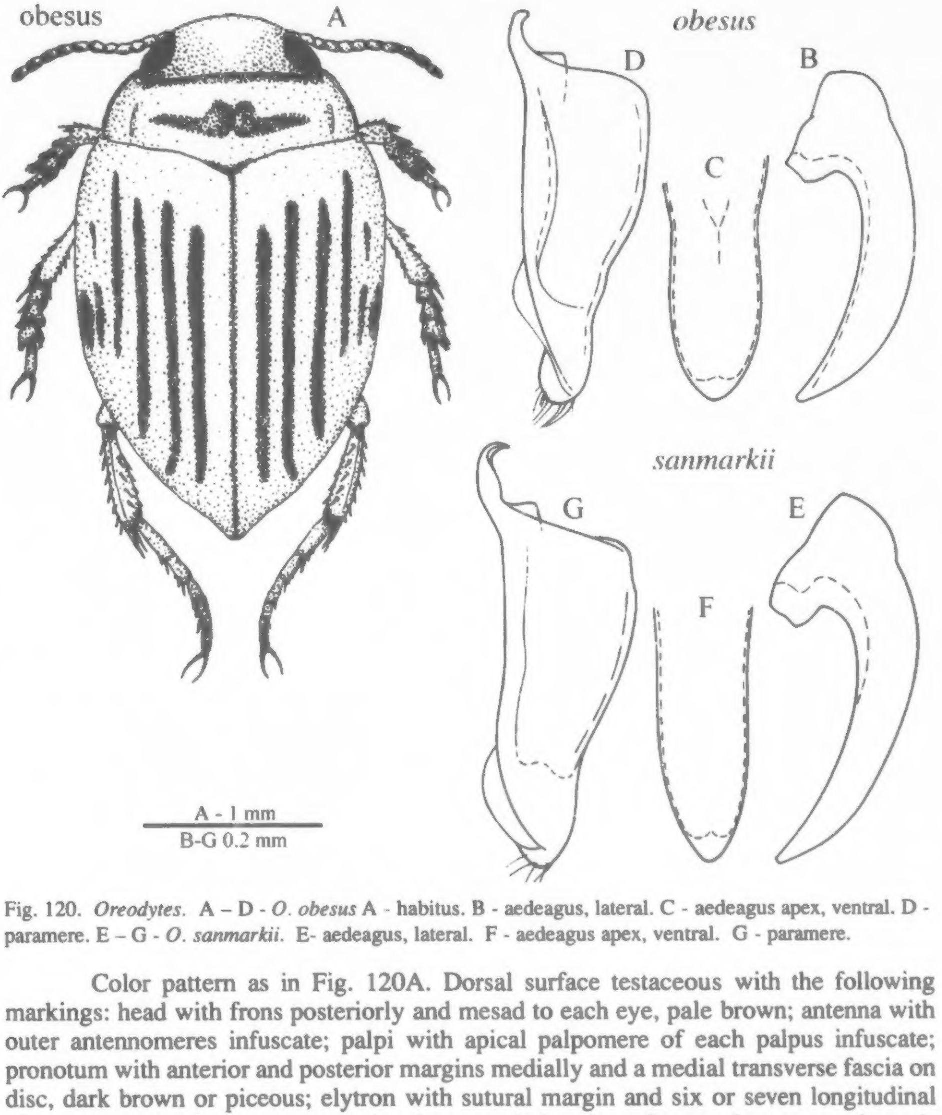


Fig. 120. *Oreodytes*. A – D - *O. obesus* A - habitus. B - aedeagus, lateral. C - aedeagus apex, ventral. D - paramere. E – G - *O. sanmarkii*. E- aedeagus, lateral. F - aedeagus apex, ventral. G - paramere.

Color pattern as in Fig. 120A. Dorsal surface testaceous with the following markings: head with frons posteriorly and mesad to each eye, pale brown; antenna with outer antennomeres infuscate; palpi with apical palpomere of each palpus infuscate; pronotum with anterior and posterior margins medially and a medial transverse fascia on disc, dark brown or piceous; elytron with sutural margin and six or seven longitudinal vittae, piceous (vittae may be variously expanded and confluent of some specimens). Ventral surface piceous to black. Legs testaceous to brown with at least apex of femora and tibia medially, testaceous.

Dorsal surface very finely punctate, elytral punctures much smaller than serial punctures. Ventral surface lightly punctate, metacoxa with punctures small.

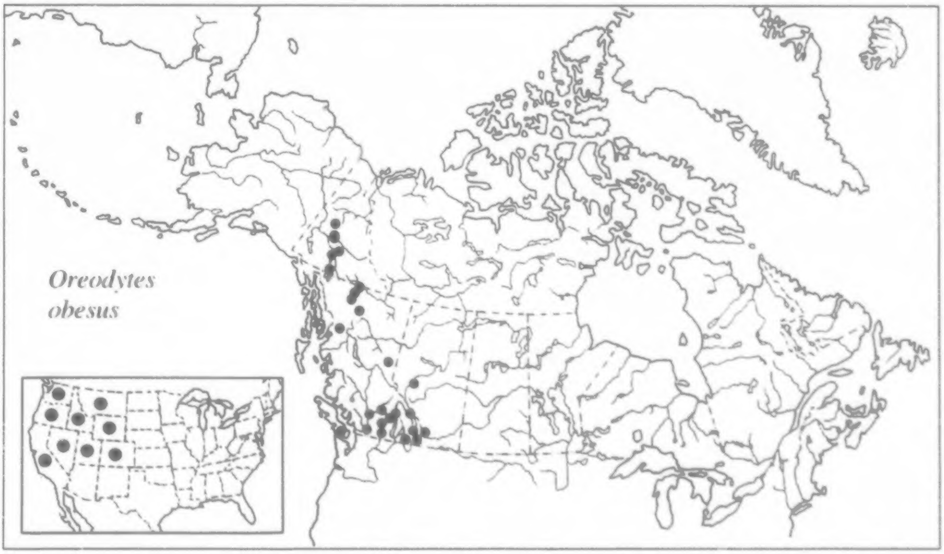
Elytron with epipleuron hidden behind lateral margin of elytron posterad of humeral angle in lateral aspect. Metacoxal lines diverging anteriorly. Abdominal sterna not inflated or modified. Length of metafemur: length of metatrochanter = 2.00 to 2.32; metatrochanter with hind margin sparsely setose. Sexes similar.

Aedeagus (Fig. 120B, C) short and broad.

Comments. This species has been referred to as *O. rivalis* (Gyllenhal) (a junior synonym of *O. sanmarkii* (Sahlberg) by several authors (e.g., Larson 1975, Zimmerman 1985). However, Larson (1990*b*) showed that the two species are distinct. Zimmerman (1985) recognized two subspecies, one in coastal Washington and Oregon to which the name *obesus* applies, and a widespread inland form which he called *rivalis*. Since the name *rivalis* has been shown to belong to a separate species, the available name for the species is *obesus* and Larson proposed the name *cordillerensis* for the inland subspecies.

Ecology. These insects occur in eddies or slowly moving water along the margins of clear small streams to moderate sized rivers. They also occur on sand and gravel on wave-washed shores of cold lakes. The insects generally occur where water movement scours the substrates keeping them free of silt. Alarie (1997) described the larva.

Distribution. Map 144. Two subspecies are recognized: *O. o. obesus* (LeConte) occurs in western California and Oregon; *O. o. cordillerensis* Larson occurs along the Rocky Mountains from the southern Yukon territory to Colorado and west to the Pacific in British Columbia and Washington. The two subspecies hybridize in Washington and northern Oregon (Zimmerman 1985).



Map 144. *Oreodytes obesus* (LeConte). Canadian and Alaskan collection localities and United States state records.

9. *Oreodytes sanmarkii* (C. R. Sahlberg 1826)

Fig. 120E – G

Hyphydrus sanmarkii C. R. Sahlberg 1826: 172–173. Type locality - "Lapponiae".

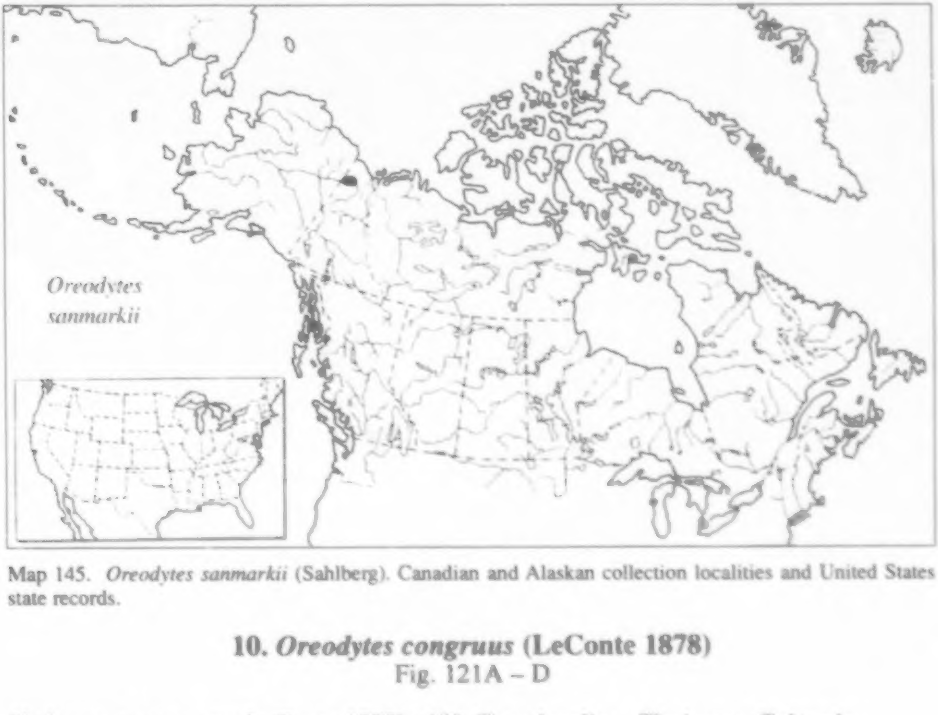
Selected References. Larson 1990: 295 – 303; Nilsson and Holmen 1995: 74 – 75; Alarie 1997: 436 – 437.

Description. Length = 2.8 to 3.2 mm; width = 1.7 to 1.8 mm; length: width = 1.66 to 1.82. Body ovate but slightly more elongate than that of the similar *O. obesus*.

Similar to *O. obesus*, differing as follows: body on average narrower, pronotum with lateral margins not continuous in curvature with elytra in dorsal aspect, hind angles more rounded; metafemur longer relative to metatrochanter, ratio length metafemur/ length of metatrochanter = 2.39 to 2.71; metatrochanter with hind margin densely punctate and setose. Aedeagus (Fig. 120E, F) slightly slenderer in both lateral and dorsal aspects.

Ecology. Young (1960) reported that specimens from Southampton Island, Northwest Territories, were collected from sheltered sites along the banks of a river. Nilsson and Holmen (1995) stated the species occurs in both streams and along exposed northern lake shores, on bottoms of sand and gravel. Alarie (1997) described the larva.

Distribution. Map 145. This species has a wide distribution in alpine and arctic regions of the Palaearctic. In North America, it is known from a few localities in the western arctic east to Banks Island.



Map 145. *Oreodytes sanmarkii* (Sahlberg). Canadian and Alaskan collection localities and United States state records.

10. *Oreodytes congruus* (LeConte 1878)

Fig. 121A – D

Hydroporus congruus LeConte 1878b: 452. Type locality - Florissant, Colorado.

Selected References. Larson 1975: 324; Zimmerman 1985: 115; Alarie 1997: 439 – 440.

Description. Length = 2.5 to 2.9 mm; width = 1.5 to 1.8 mm; length: width = 1.62 to 1.71. Small, body short and broadly oval, somewhat depressed (Fig. 121A).

Color pattern as in Fig. 121A. Head and pronotum with ground color yellow to brown. Pronotum with anterior margin narrowly piceous, lateral margins narrowly infuscate, disc medially nebulously darkened between sublateral impressions or some specimens with marking more discrete and in the form of a transverse piceous mark. Elytron with ground color yellowish, marked as follows: sutural margin narrowly

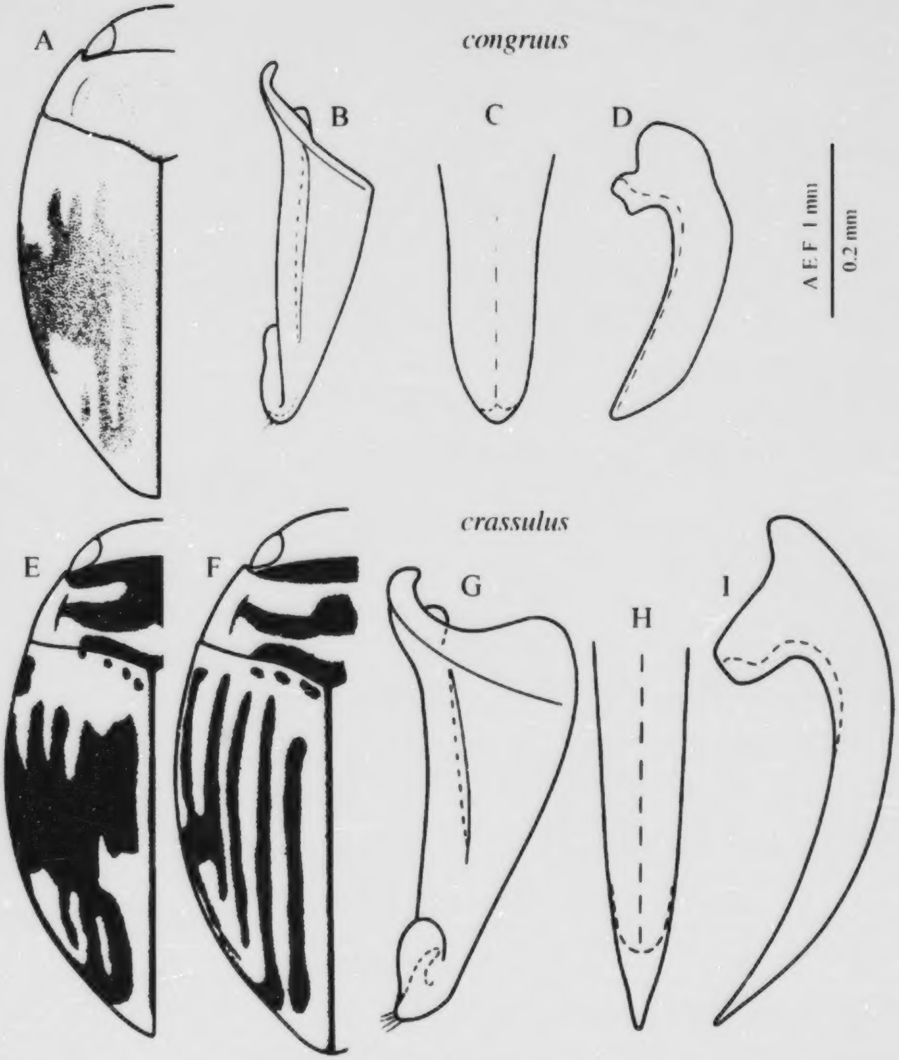


Fig. 121. *Oreodytes*. A – D - *O. congruus*. A - left body outline, dorsal. B - paramere. D - aedeagus apex, ventral. D - aedeagus, lateral. E – I - *O. crassulus*. E - left body outline and color pattern, Idaho. F - left body outling and color pattern, Alberta. G - paramere. H - aedeagus apex, ventral. I - aedeagus lateral.

piceous; disc with 6 rufous or dark brown vittae which originate well posterad of basal margin, these vittae separate and distinguishable on some specimens, but most with vittae broadly expanded and contiguous to form a large more or less unicolorous cloud covering much of disc; epipleuron pale. Ventral surface mainly piceous to black with lighter areas more expanded than in related species; prosternal process, metepisternum, metacoxal process, and posterior margins of sterna 3 to 6 rufous to piceous.

Elytron except for serial punctures and a sparse row of fine punctures along sutural margin, virtually impunctate. Metasternal wing with a row of coarse punctures bordering metacoxal plate. Metacoxal plate with small, deep, more or less equal sized punctures which are conspicuous because of light reticulation and smooth surface of plate.

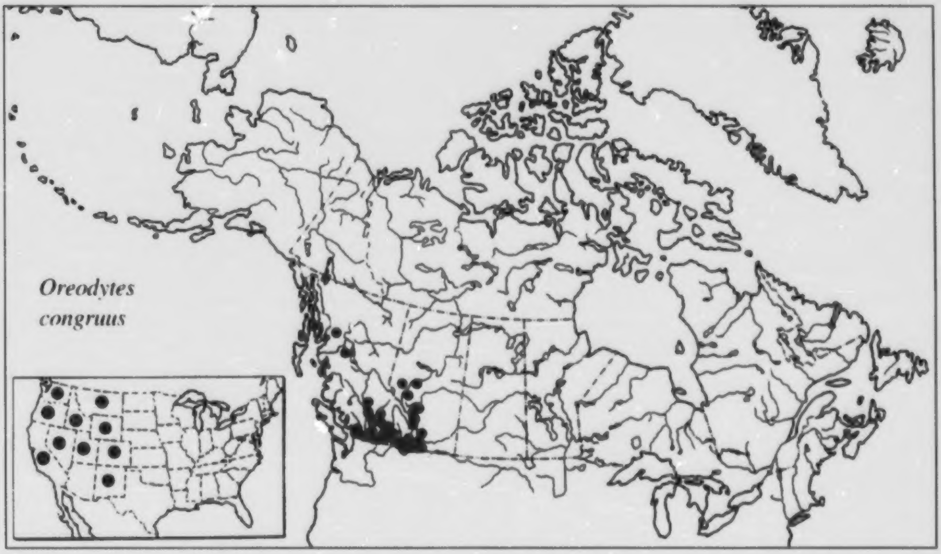
16

Pronotum with lateral margin narrow, not thickened at posterolateral angle. Elytron in lateral aspect with epipleuron hidden behind lateral margin posterad of shoulder.

Male aedeagus (Fig. 121C, D) in lateral aspect little arcuate, short and bluntly pointed.

Ecology. This species occurs in pools and quiet areas of small, clear mountain streams. The beetles occur on mineral substrates. This species is generally found in smaller streams than related species of the genus (Larson 1985).

Distribution. Map 146. The range extends from Alberta and central British Columbia south to New Mexico and California.



Map 146. *Oreodytes congruus* (LeConte). Canadian and Alaskan collection localities and United States state records.

11. *Oreodytes crassulus* (Fall 1923)

Fig. 121E – I

Hydroporus crassulus Fall 1923: 119. Type locality - western Montana.

Selected References. Larson 1975: 324; Zimmerman 1985: 116; Alarie 1997: 435 – 436.

Description. Length = 2.9 to 3.3 mm; width = 1.6 to 2.0; length: width = 1.65 to 1.70. A moderate sized, ovate species (Fig. 121E, F).

Head and pronotum with ground color pale brown. Pronotum with anterior margin broadly darkened; lateral margins narrowly piceous; disc medially with a transverse maculation which on some specimens is broadened and contacts dark anterior margin. Elytron yellow with longitudinal vittate maculation, vittae separate on some specimens, but on many vittate broken and variously laterally confluent producing a somewhat variegated pattern (variation in color pattern shown in Fig. 121E, F). Ventral surface rufopiceous to black.

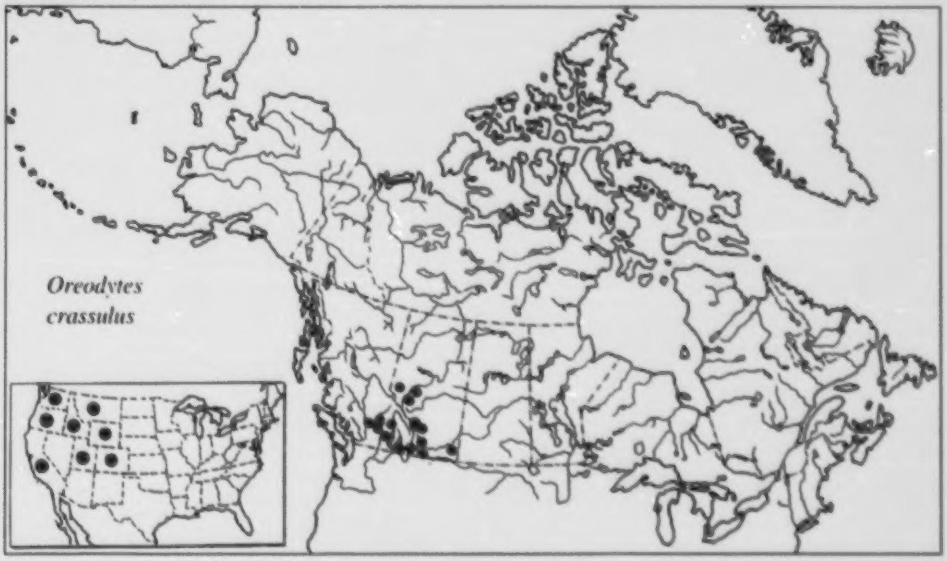
Pronotum and elytron distinctly punctate, punctures of elytron subequal to or larger than serial punctures. Metacoxal plate strongly punctate, punctures subequal to or only slightly smaller than those along hind margin of metasternal wing.

Pronotum with lateral bead narrow except on posterolateral angle where it is distinctly broadened. Elytron in lateral aspect with epipleuron hidden behind lateral margin posterad of shoulder.

Aedeagus (Fig. 121H, I) in lateral aspect relatively slender, evenly and slightly arcuate and evenly narrowed to pointed apex.

Ecology. All of the short, rounded species of *Oreodytes* occur in streams, usually in quiet water adjacent to riffle areas. They are generally found in clear water and on mineral substrates. This species appears to be more tolerant of warmer water and siltier substrates than similar species for it occurs on average in lower positions in drainage systems and in warmer more low gradient stream sections (Larson 1985).

Distribution. Map 147. The range extends from southern Alberta and British Columbia to Colorado, Utah and California.



Map 147. *Oreodytes crassulus* (Fall). Canadian and Alaskan collection localities and United States state records.

12. *Oreodytes angustior* (Hatch 1928)
Fig. 122A – D

Hydroporus angustior Hatch 1928: 221. Type locality - Renton, Washington.

Selected References. Larson 1975: 325; Zimmerman 1985: 112; Alarie 1997: 414 – 415.

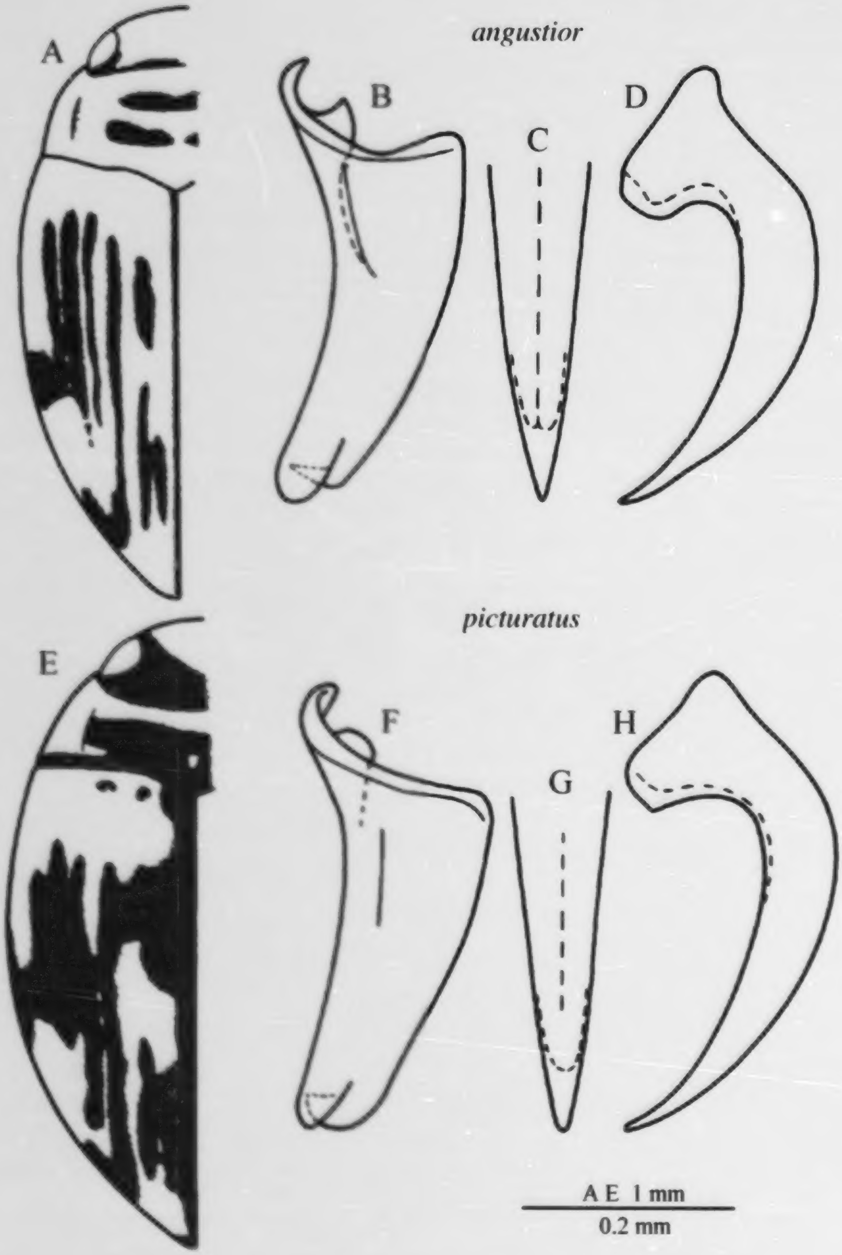

angustior
A
B
C
D
picturatus
E
F
G
H
A E 1 mm
0.2 mm

Fig. 122. *Oreodytes*. A – D - *O. angustior* A - left body outline, dorsal. B - paramere. C - aedeagus apex, ventral. D - aedeagus, lateral. E – H - *O. picturatus*. E - left body oultine, dorsal. F - paramere. G - aedeagus apex, ventral. H - aedeagus lateral.

Description. Length = 2.8 to 3.0; width = 1.5 to 1.7 mm; length: width = 1.76 to 1.87. Body (Fog. 122A) short and rounded but slightly more elongate than related species such as *O. obesus*.

Color (Fig. 122A) yellow with darker dorsal maculations. Pronotum with apical and basal margins piceous; disc with a short transverse subapical mark (narrowly separated from or continuous with front margin) and a transverse posterior mark (medially divided to form a pair of marks on some specimens, and may be continuous with base). Elytron with sutural margin broadly black; disc with about six longitudinal vittae, vittae 1 and 2 broken medially on many specimens and vittae with tendency towards lateral fusion; epipleuron pale. Ventral surface reddish brown to piceous. Legs pale.

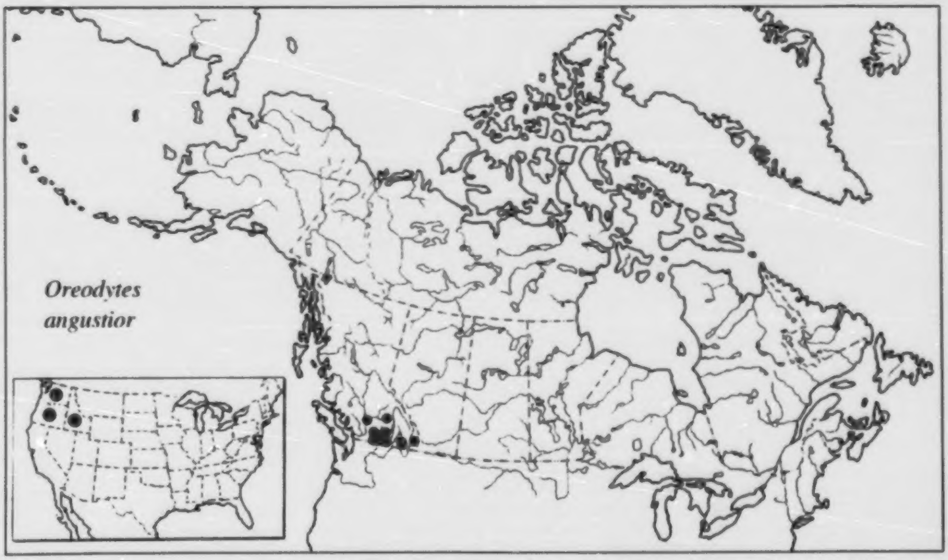
Elytra basally and medially with coarse punctures, these sparser and finer or obsolete laterally and apically. Metacoxal plate mesally and anteriorly with large punctures, punctures smaller laterally and posteriorly.

Pronotum with posterolateral angle narrowly rounded; lateral bead narrow, not conspicuously broadened at hind angle. Metacoxal lines slightly divergent anteriorly.

Adeagus (Fig. 122C, D) narrowly pointed apically.

Ecology. Specimens have been collected from eddies and quiet water along the margins of moderate sized rivers. Zack (1992) reported specimens to occur mainly along undercut banks where exposed tree roots trap floating debris. Alarie (1997) described the larva.

Distribution. Map 148. This species is known from southern British Columbia, Idaho, Washington and Oregon.



Map 148. *Oreodytes angustior* (Hatch). Canadian and Alaskan collection localities and United States state records.

13. *Oreodytes picturatus* (Horn 1883)
Fig. 122E – H

Hydroporus picturatus Horn 1883: 283. Type locality - western Nevada.

Selected References. Zimmerman 1985: 117; Alarie 1997: 412 – 414.

Description. Length = 2.6 to 3.0 mm; width = 1.5 to 1.8 mm; length: width = 1.67 to 1.75. Body (Fig. 122E) short, ovate.

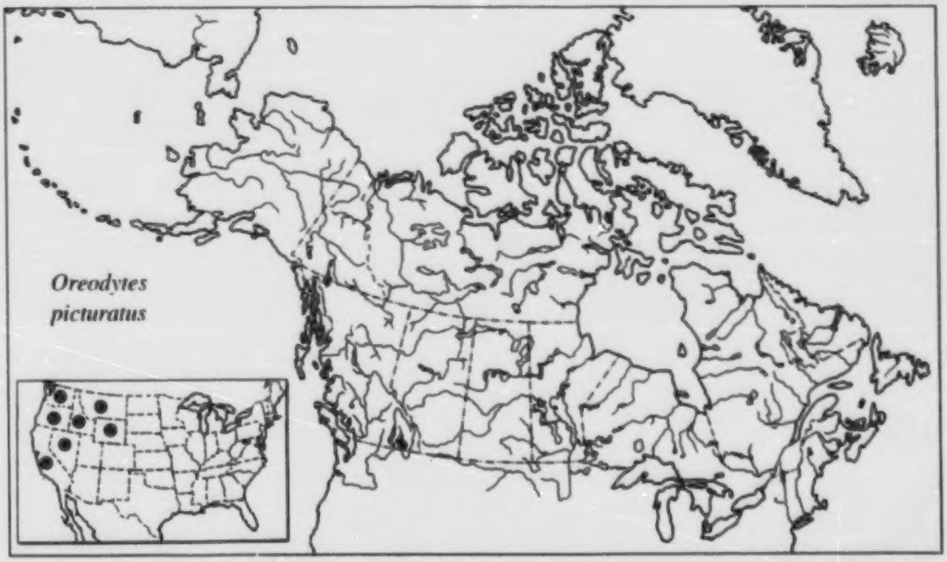
Color (Fig. 122E) yellow with dark dorsal markings. Pronotum with anterior margin broadly black; basal margin narrowly black, confluent with a broad postmedial discal fascia; lateral margins narrowly infuscate. Elytron with sutural margin black; disc with vittae variously fused to produce a dark cloud with paler areas basally, along lateral margin except near middle and medially adjacent to dark sutural margin; epipleuron pale brown. Ventral surface brown to piceous, darkest on metasternum and metacoxal plates. Legs reddish brown.

Dorsal surface very finely micropunctate. Pronotum basomedially and elytron medially coarsely punctate. Metasternum medially very coarsely punctate; metacoxal wings with coarse punctures mesally, punctures becoming smaller laterally.

Pronotum with lateral bead narrow, not broadened on posterolateral angle. Metasternum medially flattened and coarsely punctate, this region demarcated laterally by longitudinal ridge or narrowly convex region.

Aedeagus (Fig. 122G, H) evenly narrowed and pointed apically.

Ecology. The Canadian habitat is not known. Zack (1992) found specimens in grassy overhangs of streams with open shorelines. Alarie (1977) described the larva.



Map 149. *Oreodytes picturatus* (Horn). Canadian and Alaskan collection localities and United States state records.

Distribution. Map 149. The range extends from central California north to southern British Columbia and east to Wyoming (Zimmerman 1985). The species is uncommon outside of California (Zack 1992).

SUBFAMILY COLYMBETINAE ERICHSON 1837

Diagnosis. Medium size to large, length = 5.0 to 20.0 mm.

Shape, color and sculpture highly varied; body glabrous except for usual sensory and natatorial setae.

Eye with anterior margin emarginate above base of antenna. Pronotum with lateral bead present or absent. Scutellum visible. Prosternum not declivitous medially, prosternum and its process more or less in same plane in lateral aspect; apex of prosternum contacting metasternum and narrowly separating mesocoxae. Mesocoxal cavity open laterally, contacted by metepisternum. Metacoxal process with lobe covering base of trochanter, hind margin not adpressed to level of abdominal sternum 2. Pro- and mesotarsi pentamerous. Hind legs without apically bifid setae.

Male with protarsomeres 1 to 3 variously dilated but not conjointly forming a round or oval palette; ventrally bearing adhesive setae or scales of various form. Male genitalia various; parameres largely separated along dorsal margin and without a large preputial covering. Female genitalia various.

Comments. This diverse subfamily has generally been used as a dumping ground for medium sized dytiscids. For example, members of Copelatinae, Agabetinae and Hydrotrupinae, here treated as separate subfamilies, were long considered to be colymbetines. Even with these groups removed, it is unlikely that the remaining colymbetine genera form a monophyletic group. For example, members of Matini and Coptotomini possess a number of peculiar characteristics that make their placement within Colymbetinae uncertain. The remaining North American genera of the subfamily fit into two well defined tribes, Agabini and Colymbetini, which are supported by both larval and adult characters.

Ecologically these insects are very diverse. Most are lentic but some species are found only in flowing water, some at the margins of even very swift streams. These insects generally occur in shallow areas at the margins of water bodies and usually among dense vegetation or plant debris or under cover.

Key to tribes and genera of Colymbetinae of North America

1. Prosternum and its process with a deep, medial, longitudinal groove (Fig. 174B); clypeus with anterior margin broadly and distinctly emarginate medially . . . . .tribe Matini, *Matus* Aubé. p. 737

1'. Prosternum and its process flat or longitudinally convex medially, without a longitudinal groove; clypeus with anterior margin more or less straight or at most faintly concave 2

2(1). Maxillary and labial palpi with apical palpomere asymmetrically bifid apically; prosternum in lateral aspect with anterior margin almost vertical, extending below level of apex of procoxae then angled at almost a right angle and level with midline of prosternal process ....tribe Coptotomini, *Coptotomus* Say, p. 732

2'. Palpi with apical palpomeres entire; prosternum in lateral aspect not or very slightly descendant at anterior margin 3

3(2). Metafemur ventrally with a linear series of setae on posteroapical angle; or if setae present but irregular in distribution, metatarsal claws equal ....tribe Agabini, 4

3'. Metafemur ventrally lacking setae on posteroapical angle or if present, setae distributed irregularly and not forming a distinct row; metatarsal claws unequal ....tribe Colymbetini, 7

4(3). Metacoxal lines parallel, more or less parallel to apex of metacoxal lobes (Fig. 172B) ....*Agabinus* Crotch, p. 728

4'. Metacoxal lines narrowest anterior to metacoxal processes, diverging posteriorly onto metacoxal processes and anteriorly towards metasternum 5

5(4). Labial palpus with penultimate palpomere triangular in cross-section, with three well defined longitudinal ridges; mentum longitudinally ridged .... *Carrhydrus* Fall, p. 694

5'. Labial palpus more or less cylindrical, without longitudinal ridges; mentum without longitudinal ridges 6

6(5). Metatarsal claws subequal in length, or if slightly dissimilar, claws short and not more than 0.25 length of metatarsomere 5; female sternum 6 with apex evenly rounded or truncate medially; gonocoxa without ventral teeth ....*Agabus* Leach, p. 481

6'. Metatarsal claws unequal in length (Fig. 169); female sternum 6 emarginate medially; gonocoxa strongly sclerotized, ventroapical margin toothed .... Ilybius Erichson, p. 698

7(3). Elytron with numerous transverse, subparallel grooves (Fig. 180A) ....*Colymbetes* Clairville, p. 760

7'. Elytron with sculpture various, generally of meshes of various sizes but without strong transverse grooves 8

8(7). Pronotum without a lateral bead; large, length = 13.5 to 17 mm (Fig. 176A); elytron with large, irregular polygonal meshes ....*Neoscutopterus* Balfour-Browne, p. 742

8'. Pronotum with lateral bead although bead may be weakly defined on some specimens; size and color various but if large and black, elytron with small, irregular meshes or lines of sculpture partly effaced and densely punctate 9

9(8). Prosternal process flat; pronotum widely margined laterally .... *Hoperius* Fall 1927*a*
[one species, *H. planatus* Fall 1927*a*, eastern United States; immature stages Spangler 1973]

9'. Prosternal process convex to more or less longitudinally carinate medially; pronotum with width of lateral bead various, usually narrow to moderate .... *Rhantus* Dejean, p. 746

Tribe Agabini Thomson 1867

Diagnosis. Length medium, 5 to 14 mm. Shape various.

Color various, most specimens piceous to black but many with ground color yellow to brown; elytra immaculate, with sublateral spots or some specimens with longitudinal vittae. Surface glabrous except for usual fixed setae; with or without micropunctation; sculpture various, usually of meshes of various size and shape and/or with isodiametric microreticulation.

Palpi with apical palpomere entire. Pronotum with lateral bead well developed. Prosternal process various, short and barely touching metasternal lobe to elongate and apically pointed and received into well developed anteromedial impression on metasternum; metasternal wings broad to very narrow. Metacoxa with rounded lobes, lines diverging on lobes, converging anterior to lobes then diverging anteriorly. Hind legs slender to broad; metafemur with setae of posterior apicoventral angle arranged in a short row on most specimens; metatibia without bifid setae on posterior (upper) face; male with natatorial setae present on hind margin of metafemur and outer margin of metatarsomeres, absent from females of most species; metatarsomeres with hind margin truncate to distinctly lobed; metatarsal claws subequal to dissimilar in length and shape.

Male protarsomeres 1 to 3 not to strongly dilated, with various size and density of adhesive vestiture ventrally; protarsal claws variously modified. Genitalia with parameres symmetrical, setose apically. Female ovipositor various, lightly sclerotized and setose to heavily sclerotized and bearing serrulate teeth.

Comments. The members of this tribe form a dominant element of water beetles faunas over much of the world, especially in northern portions of the Holarctic region. Most species occur in the vegetation-rich margins of small, often temporary, ponds although the group is ecologically diverse and many species occur only in flowing water. Life cycles are highly varied, and generally correlated with habitat type and latitude (Hilsenhoff 1986; Nilsson 1986*a*).

Through the work of Fall, Leech, Larson and Nilsson, the North American species are quite well known. However, the supraspecific classification is in a state of flux and it is likely the genera will have to be extensively redefined as phyletic relationships are better understood. Studies of larval stages by Nilsson (1982*b*) have shown it is possible to identify the larvae of many species, but only on a regional bases where the species pool is limited.

Genus *Agabus* Leach 1817

Figs. 123 – 165

Agabus Leach 1817: 69, 72. Type species – *Agabus paykullii* Leach (= *Dytiscus serricornis* Paykull 1799), by monotypy.

Diagnosis. Size moderate, length = 5.0 to 12.5 mm. Body shape various but generally ovate and variously depressed, more convex dorsally and flattened ventrally. Color various, yellow or pale brown to black; some specimens with dorsal surface faintly metallic; head with a pair of paler spots on frons between eyes (frontal spots); some specimens with pronotum and elytra variously maculate. Dorsal surface glabrous except for usual series of setae.

Head with antenna of most specimens filiform, but submoniliform, serrate or clavate on some specimens; clypeus with anterolateral fovea (setae bearing impressions) various, short and restricted to anterolateral corners or expanded and forming a more or less complete groove across anterior margin. Pronotum with lateral bead present. Elytron with epipleuron narrowed apically and disappearing before elytral apex. Prosternum medially and its process more or less in same plane in lateral aspect or process slightly stepped down onto a lower plane at neck (narrowed portion of process between procoxae) or process short and deflected upwards posterad to procoxae; process various in shape and convexity. Metasternum with anteromedial impression slightly to well developed; metasternal wing of varied width, broad to very narrow. Metatibia with a small group of short, stiff setae near posteroapical angle, these setae linearly arranged and forming a distinct comb on most specimens but irregularly placed on some specimens; metatarsomeres not or only slightly lobed apically; metatarsal claws subequal in length, or if slightly dissimilar in length and shape, then very short and less than one-quarter length of metatarsomere 5.

Male protarsomeres 1 to 3 slightly to rather broadly dilated, pro- and mesotarsomeres 1 and 2 and also 3 of most specimens bearing ventral adhesive setae of various sizes; protarsal claws of most species modified. Parameres symmetrical, attaining apex of aedeagus, apex and mesal margin setose; with a triangular basal sclerite and a style-like apical piece (stylate form) or entirely sclerotized and somewhat strap-like. Female lacking natatorial setae on inner margin of metatibia and outer margins of metatarsomeres; sternum 6 not emarginate apically; gonocoxae various but not toothed or serrate along dorsal margin.

Comments. This large genus is primarily Holarctic with only a few species entering northern Central America and Africa. One hundred and six species occur in North America. Most of the species are quite well known, however their classification is in a state of flux. There is considerable diversity within the genus and it is likely the genus as presently defined is polyphyletic or paraphyletic. For example, Fery and Nilsson (1993) suggest that *Ilybius* is the sister taxon to some groups within *Agabus*. It is almost certain that *Carrhydrus* is a highly modified member of the *A. clavicornis*- group (sensu Larson 1989) as earlier suggested by Leech (1942*a)* and Larson (1975). Larson (1989) assigned the described North American species to species groups and this arrangement is followed in the key and the species accounts.

These beetles are highly varied ecologically. Most species occur in shallow, vegetation-rich lentic habitats but many species are lotic. Habitat characteristics such as permanence, temperature, shading, type and density of vegetation, flow rates and type of substrate are correlated with the distribution of various species. Many northern species occur in vernal or snow-melt ponds where they may be the principal predators on other invertebrates, especially Diptera larvae. In southern regions a higher percentage of the species are lotic. Several different types of life history patterns in *Agabus* have been identified by Nilsson (1985). Most species overwinter in the adult stage but several overwinter as both larvae and adults or eggs and adults and a few overwinter only in immature stages. Some of the adult-overwintering species lay eggs in the spring that hatch with larvae completing development that same summer; others lay eggs that enter diapause and do not hatch until the following spring.

The larvae of many European species of *Agabus* have been described. Larval studies have demonstrated that characters for species recognition exist. However, application of larval characteristics to determining patterns of phyletic relationships has been very limited due to the fact that most differences found have been in such characters as size, color and numbers of setae, characters that are difficult to interpret phylogenetically.

The large number of species makes an identification key difficult to use. An attempt has been made to reduce the reliance on qualitative characters by reference to measurements or through comparison of relative sizes of adjacent body parts. The procedure for measuring the width of the metasternal wing and the metacoxal plate is described in the introduction. The degree of dilation of the male protarsus is indicated by the protarsal ratio which is the maximum width in dorsal aspect of each protarsomere divided by the median width of protarsomere 5 (the median width is used as protarsomere 5 is somewhat broadened apically in some species). Usually only the mean values for these ratios are given. The length of the prosternal process is a very useful character and is correlated to the length of the impression on the anteromedial lobe of the metasternum between the mesocoxae. The length of the impression (and process) is evaluated on whether its posterior limit is shorter than or surpasses a transverse line drawn at the level of the hind margin of the mesocoxal cavities. One or more of the mesotarsomeres may be elongated in males of some species. This is expressed as the ratio of the dorsal length of mesotarsomere 5 to the combined dorsal length of mesotarsomeres 1 to 4. Metatibial spur length is expressed as the ratio of the length of the longer spur to the length of metatarsomere 1. It is recommended that before attempting to key out a specimen, the total length and values for the various ratios be calculated

Key to species groups and species of *Agabus* of North America

(Note: Male characteristics of the protarsus and genitalia are used in many couplets, therefore many female specimens can not be identified with this key)

1. Clypeus with anterior bead broadly interrupted medially, median gap equal to or greater than one-third of anterior width of clypeus (medial gap may have a few isolated punctures) 2

1'. Clypeus with anterior bead well developed either as a continuous groove along anterior margin, or if broken medially then traceable as a row of closely spaced, mainly contiguous punctures, medial gap if present not greater than one-quarter of anterior width of clypeus 44

2(1). Metatarsus with at least one of tarsomeres 1 to 4 with one or more setiferous punctures on dorsal surface (Fig. 123C) . . . .*erichsoni*-group, 3

2'. Metatarsomeres without setiferous punctures on dorsal surface 5

3(2). Pronotum in dorsal aspect with lateral margin impressed and sinuate on anterolateral angle (Fig. 123A) . . .1. *A. erichsoni* Gemminger and Harold

3'. Pronotum in dorsal aspect with lateral margin evenly curved to apex of anterolateral angle 4

4(3). Aedeagus shorter, length = 1.05 to 1.25 mm, narrow in lateral aspect, apex pointed in dorsal aspect (Fig. 123G, H); width metacoxa: widthmetasternal wing = 2.3 to 2.7; eastern United States . . . . .2. *A. gagates* Aubé

4'. Aedeagus longer, length = 1.25 to 1.40 mm, broad in lateral aspect, apex in dorsal aspect broadly rounded (Fig. 123J, K); width metacoxa: width metasternal wing = 2.4 to 3.0; eastern Canada, northeastern United States . . . . .3. *A. larsoni* Fery and Nilsson

5(2). Prosternal process with lateral bead broadly inflated posterad of procoxae 6

5'. Prosternal process with lateral bead of more or less even width on basal half and not evidently inflated posterad of procoxae 18

6(5). Body in dorsal aspect with lateral margin of pronotum and elytron continuous in outline, pronotum with hind angle right angled to acute; male anterior protarsal claw with a ventral tooth or length greater than 11 mm 7

6'. Body in dorsal aspect with lateral margin of pronotum and elytron slightly to strongly discontinuous in outline, pronotum with posterolateral angle obtuse to somewhat rounded; male anterior protarsal claw of most specimens not toothed ventrally; elytron without pale sublateral vitta 13

7(6). Size very large, length = 9.5 to 12.5 mm; elytron with a short postmedial sublateral pale spot; metacoxal plate with lines lightly impressed and very densely punctate; male anterior protarsal claw without a ventral tooth; aedeagus peculiarly modified, in dorsal aspect broadened in distal half, truncated subapically with left side of truncation slightly produced as a broad lobe, right side extended as an elongate, slender spine with apex produced as two asymmetric lobes (Fig. 135B-D) . . . .*confusus*-group, 29. *A. confusus* Blatchley

7'. Smaller, length = 6.7 to 9.6 mm; elytron with an elongate sublateral vitta in apical half (vitta may be broken medially on some specimens); metacoxal plate with lines not evidently punctate; male anterior protarsal claw with a ventral tooth located either medially or basally (Fig. 130); aedeagus with apex pointed . . . . *semivittatus*-group, 8

8(7). Male protarsus narrow, width protarsomere 1 = 0.12 to 0.13 mm; protarsomere 1 ventrally with adhesive setae at extreme apex only; anterior protarsal claw (Fig. 130A) gradually and evenly arcuate in anterior aspect, with a small, acute ventral tooth; aedeagus (Fig. 131A, B) short, length = 1.3 to 1.4 mm, its apex laterally flattened and curved to right; small species, mean length less than 8.4 mm (range 6.4 to 8.8 mm); Quebec and New York to California, not in coastal southeastern United States ....17. *A. semivittatus* LeConte

8'. Male protarsus wider, width protarsomere 1 = 0.15 to 0.29 mm; protarsomere 1 ventrally with more extensive adhesive setae, setae smallest basally and larger along apical margin; anterior protarsal claw various, either strongly arcuate basally with a large basoventral tooth or elongate; aedeagus more elongate, length = 2.0 to 2.4 mm, apex various; larger, mean length greater than 8.0 mm (range 7.6 to 9.6 mm); eastern North America east of Great Plains and Gulf Coast 9

9(8). Aedeagus with apex rounded (Fig. 131C – F), without an acute ventral projection; male protarsus narrower, width protarsomere 1 = 0.15 to 0.19, ratio width protarsomere 1: protarsomere 5 less than 2.0; metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.32 to 4.22; body more convex, length: depth = 2.76 to 3.21 ... 10

9'. Aedeagus apex with a small, acute ventral hook (Fig. 131G - K); male protarsus broad, width protarsomere 1 = 0.22 to 0.29 mm, ratio width protarsomere 1: width protarsomere 5 = 2.0 or greater; metasternal wing broader, width of metacoxa: width of metasternal wing = 2.80 to 3.42; body more flattened, length: depth = 3.00 to 3.62 11

10(9). Aedeagus in lateral aspect widened medially and obliquely flattened on ventral surface (Fig. 131C, D); female with apex of elytron with fine more or less isodiametric sculpture with small, regular punctures; Florida .... 18. *A. johannis* Fall

10'. Aedeagus slender, in lateral aspect parallel sided medially or evenly narrowing to apex, not flattened on ventral surface (Fig. 131E, F); female apex of elytron with sculpture fine but meshes irregular in shape and generally with transverse orientation, punctation very faint; Atlantic coast from Long Island to Florida, Gulf coast to Alabama ....19. *A. astrictovittatus* Larson and Wolfe

11(9). Male protarsal claws elongate (Fig. 130D), anterior claw longer and broader in lateral aspect than posterior claw; pronotum in lateral aspect (Fig. 129A) with lateral margin slightly but distinctly curved upwards on anterolateral angle; coastal, New York to Florida and Alabama ....20. *A. stagninus* (Say)

11'. Male protarsal claws shorter (Fig. 130G, H), anterior and posterior claws subequal in length, anterior claw strongly arcuate medially and with a large basoventral tooth; pronotum in lateral aspect (Fig. 129B) with lateral margin more or less straight and not curved up on anterolateral angle 12

12(11). Aedeagus with large rounded basal apodemes (Fig. 131I, J); male protarsus broader, width protarsomere 1 = 0.22 to 0.29 mm, protarsal ratio = 2.47: 2.01: 1.45: 1.13: 1; female elytron with lines deep and meshes more or less granulate; Ontario to Tennessee and Arkansas .... 21. *A. flavovittatus* Larson and Wolfe

12'. Aedeagus with basal piece small, apodemes very narrow (Fig. 131K); male protarsus narrower, width protarsomere 1 = 0.17 to 0.20 mm, protarsal ratio = 2.03: 1.72: 1.36: 1.17: 1; female elytral sculpture shallow and similar to that of male; Texas .... 22. *A. texovittatus* Larson and Wolfe

13(6). Antennomeres short (Fig. 133E), length of antenna less than width of head across eyes; male metatibia with inner margin and metatarsomeres with outer margins lacking natatorial setae; male protarsomeres 1 or 1 and 2 only with small adhesive scales beneath; length = 5.5 to 7.5 mm .... *spinipes*-group, 14

13'. Antennomeres normal, length of antenna subequal to or longer than width of head across eyes; male metatibia and metatarsomeres with natatorial setae; male protarsomeres 1 to 3 with adhesive vestiture on ventral surfaces; length = 8.0 to 10.0 mm .... *americanus*-group, 17

14(13). Male metafemur with hind margin distinctly angulate or toothed distad to apex of metatrochanter (Fig. 133G, H); Mexico 16

14'. Male metafemur with hind margin smoothly arcuate, without angulation or tooth; New Mexico, Arizona, northern Mexico 15

15(14). Male protarsus narrow, dorsal width protarsomere 1 = 0.16 to 0.18 mm; protarsal ratio = 1.82: 1.56: 1.22: 1.10: 1; pronotum with posterolateral angle obtuse but distinct (Fig. 133A); southwestern United States .... 25. *A. apache* Young

15'. Male protarsus relatively broad, dorsal width protarsomere 1 = 0.18 to 0.21 mm; protarsal ratio = 1.98: 1.68: 1.30: 1.14: 1; pronotum with posterolateral angle broadly rounded and more or less obsolete (Fig. 133B); Chiapas, Mexico .... 26. *A. maya* new species

16(14). Male anterior protarsal claw without a ventral tooth; aedeagus in dorsal aspect abruptly dilated medially (Fig. 134H) ..... 27. *A. spinipes* Sharp

16'. Male anterior protarsal claw with a broad but distinct ventral tooth (Fig. 134J); aedeagus in dorsal aspect gradually widened medially (Fig. 134L) .... 28. *A. aztec* new species

17(13). Male anterior protarsal claw elongate, subequal in length to length of protarsomere 5; width protarsomere 1 = 0.2 to 0.25 mm; aedeagus with angulation between basal piece and shaft more abrupt (Fig. 132E) .... 23. *A. americanus* Sharp

17’. Male anterior protarsal claw short, 0.6 to 0.7 length of protarsomere 5; width protarsomere 1 = 0.18 mm; aedeagus with curvature between basal piece and shaft smooth (Fig. 132G) . . . . .24. *A. mexicanus* new species

18(5). Pronotum with point of maximum width well anterior to hind angles, pronotum either cordate with sides constricted and sinuate anterior of prominent hind angles or sides rounded and evidently converging towards right angled or acute hind angles (Fig. 140A – E); body elongate, parallel-sided, depressed; elytron in lateral aspect with epipleuron visible to shoulder . . . .*cordatus*-group, 19

18’. Pronotum with point of maximum width at hind angle or shortly anterior of hind angles if hind angles are broadly rounded and obtuse; body shape various; elytron in lateral aspect with epipleuron hidden behind lateral margin for a short distance posterad to shoulder 23

19(18). Pronotum about as wide as elytra across humeral angles; pronotum with lateral margins straight or only slightly converging posteriorly and not evidently sinuate (Fig. 140D, E); male anterior protarsal claw with a large ventral tooth (Fig. 140F); Mexico 22

19’. Pronotum distinctly narrower than elytra across humeral angles, most specimens with lateral margins of pronotum slightly to distinctly sinuate anterior to posterolateral angle (Fig. 140A – C); male anterior protarsal claw without a ventral tooth 20

20(19). Antenna with outer antennomeres infuscate apically; palpi vaguely to distinctly infuscate; prosternal process more elongate and sharply pointed apically; Alberta, British Columbia to Colorado, Utah and California . . . . .39. *A. bjorkmanae* Hatch

20’. Antennae and palpi without infuscation; prosternal process shorter and broader, more bluntly pointed apically; Colorado, Utah and Nevada to Mexico 21

21(20). Pronotum strongly cordate, posterolateral angles protruding and acute (Fig. 140B); body pale brown to piceous; southwestern United States . . . . .40. *A. cordatus* LeConte

21’. Pronotum with posterolateral angles not protruding, lateral margin of pronotum at most faintly sinuate (Fig. 140C); body piceous; Mexico . . . . .41. *A. flohrianus* Sharp

22(19). Metasternal wing broad, width metacoxa: width metasternal wing = 2.77 to 3.08 . . . . .42. *A. amaroides* Sharp

22’. Metasternal wing narrow, width metacoxa: width metasternal wing = 3.92 to 4.60 . . . . .43. *A. oaxacaensis* new species

23(18). Prosternal process short; metasternum anteromedially slightly flattened or at most with a short impression for reception of apex of prosternal process, impression ending well anterior of level of hind margin of mesocoxae; elytron with meshes of primary sculpture moderately large, each intersection of lines with a puncture but punctures indistinct on some specimens with strongly stretched meshes; microreticulation present but variously developed, from more or less obsolete to very dense and granular (especially on some females with longitudinally stretched primary meshes): female gonocoxa with apex dorsally flattened and with a lateral ridge .... *opacus*-group, 24

23'. Prosternal process more elongate and sharply pointed apically, received into a well developed impression on metasternum which extends posteriorly to or almost to level of hind margin of mesocoxae; elytron with lines of sculpture with numerous small punctures but these may not be evident on specimens with deeply impressed lines; female gonocoxa laterally flattened, without a lateral ridge ....*seriatus*-group, 36

24(23). Pronotum with lateral bead very narrow, at widest less than 0.33 maximum width of a medial antennomere; pronotum with posterolateral angle slightly produced and acute, otherwise pronotal base almost evenly truncate (Fig. 124A) 25

24'. Pronotum with lateral bead broader, or if less than 0.50 maximum width of a medial antennomere, pronotum with posterolateral angle evidently rounded and obtuse; pronotum with base truncate to broadly rounded and distinctly emarginate each side of scutellum (Fig. 124B – H) 26

25(24). Larger, length = 7.1 to 9.0 mm; each palpus with apical palpomere infuscate; frons without distinct punctures at level of anterior margin of eyes .... 4. *A. vancouverensis* Leech

25'. Smaller, length = 5.8 to 7.5 mm; palpi yellow, without apical infuscation; frons with one or two punctures on each side at level of anterior margin of eyes and posterad of frontal punctures of clypeal suture .... 5. *A. hypomelas* Mannerheim

26(24). Large, length = 9.0 to 11.2 mm; pronotum with lateral bead very broad, subequal in width to width of a middle antennomere; both sexes with sculpture of pronotum and elytron consisting of strongly elongate meshes; metafemur with fine but distinct strioles 27

26'. Smaller, length = 5.3 to 9.0 mm; pronotum with lateral bead narrower than maximum width of a median antennomere; sculpture various, male with meshes of elytral sculpture not or only slightly elongate, female like male or with strongly longitudinally stretched meshes or lines; metafemur without strioles .... .28

27(26). Male protarsus broad, width protarsomere 1 = 0.31 to 0.38 mm; protarsal ratio = 1.95: 1.93: 1.57: 1.01: 1; aedeagus in lateral aspect more strongly narrowed apically (Fig. 127A); coastal British Columbia to Oregon .... 10. *A. discors* LeConte

27'. Male protarsus narrower, width protarsomere 1 = 0.25 to 0.34 mm; protarsal ratio = 1.82: 1.76: 1.43: 1.04: 1; aedeagus more gradually narrowed apically (Fig. 127C); northern and eastern California .... 11. *A. austrodiscors* Larson

28(26). Metatibial spur short, 0.55 to 0.82 times length metatarsomere 1; palpi of most specimens entirely yellow, without apical infuscation (some specimens of *A. opacus* with faint apical darkening); elytron without maculation, at most gradually paler laterally; metacoxal plate with sculpture fine, most specimens with fine microreticulation and fragmented line segments, some with very fine, dense longitudinal lines not forming evident meshes 29

28'. Metatibial spur longer, 0.80 to 1.10 times length of metatarsomere 1; each palpus with apical palpomere infuscate apically; elytron of many specimens with a small, sublateral, postmedial pale spot, or some specimens with elytron yellow with longitudinal dark vittae, or some specimens entirely dark; metacoxal plate with coarse anastomosing lines not forming definite meshes, interspaces with variously effaced microreticulation 32

29(28). Larger, length = 7.1 to 8.6 mm; width of metacoxa: width metasternal wing = 2.39 to 2.96; male protarsus strongly dilated, mean protarsal ratio = 2.02: 1.83: 1.40: 1.10: 1; female sculpture like male or with dense parallel longitudinal lines and strong microreticulation giving elytron a silky sheen .... 9. *A. opacus* Aubé

29'. Smaller, length = 5.3 to 7.3 mm; width of metacoxa: width metasternal wing = 1.71 to 3.06; male protarsus narrower, mean protarsal ratio = 1.53: 1.44: 1.29: 1.12: 1; female sculpture similar to male or some specimens with meshes slightly longitudinally stretched, without silky sheen 30

30(29). Metasternal wing narrow, width of metacoxa: width metasternal wing = 2.17 to 3.06; boreal .... 8. *A. wasastjernae* (Sahlberg)

30'. Metasternal wing broad, width of metacoxa: width metasternal wing = 1.70 to 2.23; Cordilleran 31

31(30). Pronotum (Fig. 124B) with posterolateral angle more rounded, lateral margin of pronotum rounded and discontinuous in outline with elytra; elytron with microreticulation absent to largely effaced basomedially on both sexes; metasternal wing broader, width of metacoxa: width metasternal wing = 1.71 to 2.06; Alberta to Colorado, west to British Columbia and Oregon .... 6. *A. verisimilis* Brown

31'. Pronotum (Fig. 124C) with posterolateral angle more prominent, lateral margin of pronotum less rounded and only slightly discontinuous in outline with elytra; elytron with microreticulation stronger, present over entire disc of some females, variously effaced basomedially on males and some females; metasternal wing narrower, width of metacoxa: width metasternal wing = 1.87 to 2.23; California, southern Oregon .... 7. *A. vandykei* Leech

32(28). Elytron yellow with four longitudinal medial dark vittae and many specimens with one or two shorter sublateral vittae .... 16. *A. lineellus* LeConte

32'. Elytron dark rufous to piceous, markings at most consisting of a sublateral postmedial pale spot 33

33(32). Aedeagus in lateral aspect strongly narrowed to sharply pointed apex; in dorsal aspect with sides broadened subapically or not (Fig. 128A – E) 34

33'. Aedeagus in lateral aspect more gradually narrowed apically, apex more rounded; in dorsal aspect not widened subapically (Fig. 128 F – J) 35

34(33). Pronotum (Fig. 124F) broader, about as wide across base as width of elytra across shoulders; form more ovate, outline slightly discontinuous due to rounded posterolateral pronotal angles; antennae paler, most specimens with only apical antennomere infuscate; Pacific coast, California to southwestern British Columbia .... 12. *A. confertus* LeConte

34'. Pronotum (Fig. 124E) narrow, narrower at base than elytra across shoulders; shape elongate and body outline strongly discontinuous; antenna darker, at least apical 3 to 5 antennomeres infuscate; Sierra Nevada Mountains of California to northeastern Oregon .... 13. *A. euryomus* Larson

35(33). Aedeagus (Fig. 128F, G) in dorsal aspect broadened subapically; Baja California to southern Washington .... 14. *A. walsinghami* Crotch

35'. Aedeagus (Fig. 128 I, J) in dorsal aspect with lateral margins more or less parallel, not broadened subapically; Arizona .... 15. *A. jimzim* Larson

36(23). Metasternal wing broad, width of metacoxa: width metasternal wing less than 3.00 or specimen from east of the Great Plains; hind legs slender, metatibia length: width greater than 4.0; antenna and palpi of most specimens infuscate apically 37

36'. Metasternal wing narrow, width of metacoxa: width metasternal wing greater than 3.00; hind legs various, slender to very broad, metatibia length: width = 2.6 to 5.1; antenna and palpi without infuscation 39

37(36). Smaller (length = 7.6 to 9.4 mm), narrower (length: width = 1.90 to 2.04), shinier species; metasternal wing of varied width but on average narrower, width of metacoxa: width metasternal wing = 1.64 to 3.87; prosternal process almost flat medially; male anterior protarsal claw with a distinct but broad ventral tooth;transcontinental .... 32. *A. seriatus* (Say)

37'. Larger (length = 7.8 to 10.4 mm), broader (length: width = 1.76 to 1.97), body more coarsely sculptured and less shiny; metasternal wing very broad, width of metacoxa: width metasternal wing = 1.60 to 2.30;

prosternal process broadly but distinctly convex; male anterior protarsal claw slightly broadened ventrally but not distinctly toothed; southern British Columbia to Mexico, east to South Dakota 38

38(37). Inland, eastern Oregon to South Dakota, to southern California, Mexico and Texas; aedeagus (Fig. 137A) basally more evenly arcuate, apex more parallel-sided in dorsal aspect . . . . .30. *A. lugens* LeConte

38'. Pacific coast from British Columbia to Baja California, inland to Idaho and Sierra Nevada Mts.; aedeagus (Fig. 137C) basally with a distinct angulate bend, best seen on right side, apex less flattened and twisted . . . . .31. *A. perplexus* Sharp

39(36). Metatibia very broad, metatibia length: width = 2.6 to 3.2; metasternal wing narrow (Fig. 136 E), width metacoxa: width metasternal wing = 3.7 to 5.3; longer metatibia spur distinctly longer than metatarsomere 1, metatibial spur length: metatarsomere 1 length = 1.15 to 1.59 or if shorter, specimen from Colorado 43

39'. Metatibia narrower, metatibia length: width = 3.4 to 5.1; metasternal wing moderate to narrow (Fig. 136B – D), width metacoxa: width metasternal wing = 3.22 to 4.46; longer metatibial spur shorter than to slightly longer than metatarsomere 1, metatibial spur length: metatarsomere 1 length = 0.89 to 1.16 40

40(39). Sculpture coarse, metacoxal plate with deeply impressed longitudinal lines not forming distinct meshes; metatibia with ventral surface coarsely punctate; metasternal wings moderately narrow, width metacoxa: width metasternal wing = 3.2 to 3.9; hind legs moderately broad, metatibia length: width = 3.4 to 4.2 . . . . .36. *A. ilybiiformis* Zimmermann

40'. Sculpture less coarse, metacoxal plate with lines finer, forming irregular open longitudinal meshes; metatibia with punctation of ventral face evident but fine; metasternal wings various, width metacoxa: width metasternal wing = 3.2 to 5.3; hind legs of moderate width to narrow, metatibia length: width = 3.4 to 5.1 41

41(40). Metasternal wing narrow (Fig. 136D), width metacoxa: width metasternal wing = 3.7 to 4.5; hind leg moderately broad, metatibia length: width = 3.5 to 4.2; San Francisco Bay area . . . . .35. *A. brevicollis* LeConte

41'. Metasternal wing broader (Fig. 136C), width metacoxa: width metasternal wing = 3.2 to 4.3; hind leg narrower, metatibia length: width = 3.9 to 5.1; widespread California, Oregon 42

42(41). Female elytron with meshes polygonal over entire surface and not stretched longitudinally; male protarsus narrower, mean protarsal ratio = 1.70: 1.59: 1.34: 1.13: 1; male anterior protarsal claw slenderer, similar to posterior claw or with a small, low ventral tooth at base; California . . . . .33. *A. pandurus* Leech

42'. Female elytron basally with meshes strongly stretched longitudinally; male protarsus broader, mean protarsal ratio = 1.83: 1.66: 1.40: 1.13: 1; male anterior protarsal claw distinctly broader than posterior claw, with a broad anterior ventral flange; southwestern Oregon .... 34. *A. roguus* Larson

43(39). Elytron basally adjacent to suture with some lines of sculpture absent so adjacent meshes fused into elongate, sinuate meshes, most punctures distinctly in lines; metatibia with punctures of posteroventral series small and dense, series double or multiple basally; ground color rufous; metatibial spurs very broad; aedeagus (Fig. 139H) broader, more gradually constricted apically; California .... 37. *A. regularis* LeConte

43'. Elytron basally adjacent to suture with many lines very shallow or obsolete but without definite formation of elongated, sinuate meshes; punctation dense and conspicuous, many punctures isolated or situated in very faintly impressed lines; metatibia with posteroventral series of punctures coarser, single for most part; metatibial spur slenderer and shorter; ground color piceous to black; aedeagus (Fig. 139K) narrower, more strongly constricted apically; Nevada to Colorado to central Mexico ....38. *A. minnesotensis* Wallis

44(1). Aedeagus with a subapical ventral spine (Fig. 163D) although spine may be small and inconspicuous (Fig. 163J); elytron with sculpture various but North American specimens without definite dual sculpture; color various, many specimens with disc of pronotum black and contrasting with variously paler elytra 82

44'. Aedeagus without a subapical ventral spine; elytral sculpture various, some specimens with evident dual sculpture; color various 45

45(44). Male antenna clubbed (Figs. 143D; 144A); metasternal wing narrow, metacoxa extending anteriorly to level of hind margin of mesocoxal cavities (Fig. 143B); elytral sculpture consisting of regular round or hexagonal meshes .... *clavicornis*-group, 46

45'. Male antenna not clubbed; metasternal wing various, most specimens with metasternal wing broader and metacoxal plate not extending as far forward as level of hind margin of mesocoxal cavities; elytral sculpture various 47

46(45). Smaller, length = 7.3 to 8.0 mm, body depressed; male without setal brushes on legs; male protarsomere 1 with a ventral tooth (Fig. 143A) ....45. *A. antennatus* Leech

46'. Larger, length = 9.0 to 11.0 mm, body dorsally convex; male with profemur ventrally, metatibia mesally and metatarsomere 1 laterally with brushes of setae; male protarsomere 5 without a ventral tooth ....46. *A. clavicornis* Sharp

47(45). Elytron with aciculate sculpture (i.e. deeply impressed isolated lines), lines more or less longitudinal on anterior half of body, becoming transverse on posterior half of elytra; metasternal wing narrow; hind wing reduced on many specimens .... *labiatus*-group (in part), 49. *A. bifarius* (Kirby)

47'. Elytron without aciculate sculpture; metasternal wing of various width; hind wing fully developed 48

48(47). Metatibia with a row of contiguous punctures along hind margin forming a well defined submarginal groove; body elongate and relatively narrowly pointed posteriorly; elytron with dual sculpture, larger meshes obliquely or longitudinally stretched on pronotum and base of elytron of many specimens .... *tristis*-group, 49

48'. Metatibia with hind margin impunctate or with punctures clearly separated and not contiguous or forming a submarginal groove; body shape and elytral sculpture various 51

49(48). Specimens from California ....71. *A. tristis* Aubé (in part)

49'. Specimens from areas other than California 50

50(49). Metasternal wing narrower, width of metacoxa: width metasternal wing = 2.05 to 3.46; pronotum brown with a medial transverse piceous fascia (fascia expanded to cover most of disc on some specimens); epipleuron brown ....71. *A. tristis* Aubé (in part)

50'. Metasternal wing broader, width of metacoxa: width metasternal wing = 1.84 to 2.35; pronotum black with at most lateral bead rufous to piceous; epipleuron black with lateral margin paler ....72. *A. leptapsis* LeConte

51(48). Metafemur with aciculate sculpture, i.e. well developed isolated longitudinal or oblique lines; elytron with deep lines forming a network of large, irregularly shaped meshes; prosternal process of many specimens with medial convexity at base less strongly developed than on neck, apex sharply pointed and received into sharply defined metasternal impression which extends posterad to or almost to level of hind margin of mesocoxal cavities 52

51'. Metafemur without aciculate sculpture, at most some punctures elongated along lines of sculpture; elytron with sculpture various, either meshes small and more or less isodiametric or if larger and irregular then lines fine and many specimens with evident punctures present at some intersections; prosternal process various, most specimens with convexity of neck and body more or less similar, apex variously pointed but many specimens with process short and metasternal impression short and not attaining level of hind margin of mesocoxal cavities 58

52(51). Elytron with microreticulation, i.e. with fine isodiametric reticulation within larger meshes (may be obsolete basally and only visible near elytral apex of some specimens), many specimens with primary meshes longitudinally stretched on base; male protarsomeres 1 to 3 conjointly with basal area of small adhesive setae and three or four more distal transverse rows of larger oval scales .... *ambiguus*-group, 53

52'. Elytron without secondary isodiametric reticulation although meshes may be finely rugose, meshes of primary reticulation irregular basally but laterally and posteriorly with a slight tendency towards transverse arrangement; male protarsomeres 1 to 3 ventrally with large round scales ....*arcticus*-group, 57

53(52). Epipleuron yellow to testaceous, concolorous with dorsolateral portion of elytron; head and pronotum reddish yellow to dark brown 54

53'. Epipleuron piceous to black and contrasting in color with yellow to pale brown dorsolateral portion of elytron; head and disc of pronotum mainly black 55

54(53). Male protarsal claws (Fig. 153A) elongate, longer than protarsomere 5; anterior claw in dorsal aspect with anterior margin arcuately expanded; aedeagus (Fig. 153G, F) asymmetrical in dorsal aspect, apex bent slightly to right and left side partly covering medial groove medially; female pronotum (Fig. 152A) with posterolateral angle broadly rounded, primary sculpture of pronotum and base of elytron consisting of elongate, narrow meshes .... .66. *A. klamathensis* Larson and Leech

54'. Male protarsal claws (Fig. 153B) shorter than protarsomere 5, anterior claw not so expanded; aedeagus (Fig. 153I, H) with apex and dorsal groove symmetrical in dorsal aspect; female pronotum with hind angles well defined and only slightly obtuse; primary sculpture of pronotum and elytron not so longitudinally stretched .... .67. *A. austinii* Sharp

55(53). Small species, length = 5.7 to 7.1 mm; prosternal process with surface densely punctate and setose; aedeagus (Fig. 153J, K) simple, without lateral flanges or ridges .... .69. *A. strigulosus* Crotch

55'. Larger species, length = 7.4 to 10.0 mm; prosternal process shiny, sparsely punctate and setose; aedeagus (Fig. 153L – O) with lateral flanges or ridges 56

56(55). Smaller, narrower species, length = 7.4 to 8.8 mm, length: width = 1.85 to 2.04; male protarsal claws (Fig. 153C) evidently elongated but slender, mesotarsomere 5 shorter; female sculpture various but not of dense, strongly longitudinal meshes, pronotum with posterolateral angle prominent and similar in form to that of male .... .68. *A. ambiguus* Say

56'. Large, robust species, length = 8.1 to 10.0 mm, length: width = 1.75 to 1.88; male protarsal claws (Fig. 153E) greatly elongated, anterior claw broadly expanded, foliate; mesotarsomere 5 elongate; female with primary sculpture of pronotum and elytral base consisting of dense strongly stretched meshes; pronotum (Fig. 152C, D) with posterolateral angle rounded . . . . .70. *A. erythropterus* Say

57(52). Prosternal process basally distinctly convex or angulate in cross section; metatibia with posteroapical angle distinctly produced below apical comb (best developed on male); anterior protarsal claw (Fig. 157A) not toothed ventrally . . . . .73. *A. anthracinus* Mannerheim

57'. Prosternal process flat or slightly concave on basal half; metatibia with posteroapical angle not produced below apical comb; male anterior protarsal claw (Fig. 157B) with a broad ventral tooth . . . . .74. *A. arcticus* (Paykull)

58(51). Pronotum in lateral aspect with proepipleuron visible as a broad triangular piece below lateral bead on apical half (Fig. 142A); metasternal impression attaining level of hind margin of mesocoxal cavities; metatibial spurs relatively short, longest about 0.6 to 0.7 length of metatarsomere 1 . . . . .*adpressus*-group, 44. *A. adpressus* Aubé

58'. Pronotum in lateral aspect with lateral margin hiding most of proepipleuron which at most is only narrowly visible near anterior angle; metasternal impression various; metatibial spur length various, longer spur of most specimens 0.75 or more length of metatarsomere 1 59

59(58). Body broad and depressed, mesocoxae relatively broadly separated, minimal distance between them greater than one and one-half minimum distance between procoxae: prosternal process broad, surface smooth and shiny, lowly and smoothly convex to almost flat, apex received into metasternal impression which approximately attains level of hind margin of mesocoxae; elytron with fine lines forming large irregular meshes, intersections of lines not punctate but meshes with minute punctulae; antenna entirely pale, without apical infuscation; body black except each elytron laterally with a postmedial and a subapical pale spot; male protarsal claws not toothed, male lacking stridulatory organ . . . . *optatus*-group, 60

59'. Body shape various, mesocoxae separated by distance less than one and one-half distance between procoxae; prosternal process narrower and more convex; apex variously pointed, from acute to rather blunt; metasternal impression various, attaining level of hind margin of mesocoxae or not; elytron with sculpture various, many specimens with a puncture at some intersections of lines; antenna infuscate apically or not; body color various; male anterior protarsal claw bearing a ventral tooth on many specimens; male stridulatory organ present or not 61

60(59). Smaller, length = 6.5 to 8.0 mm; male protarsal claws short, shorter than protarsomere 5; aedeagus (Fig. 145B, C) short, strongly grooved on each side apically .... 47. *A. obtusatus* Say

60'. Larger, length = 8 to 9.5 mm; male protarsal claws long and straight, distinctly longer than protarsomere 5; aedeagus (Fig. 145F, G) very long and slender, dorsal groove twisted to right side apically, left side not grooved ....48. *A. planatus* LeConte

61(59). Metasternal wing narrow, metacoxa with anterior margin almost or actually attaining level of hind margin of mesocoxal cavities; prosternal process sharply pointed, its apex received into metasternal impression which extends posteriorly to level of hind margin of mesocoxae; metatibia with ventral face and basal metatarsomeres with dorsal surfaces densely micropunctate; male anterior protarsal claw not toothed; stridulatory organ absent; aedeagus (Fig. 146F, G) slender and evenly narrowed to apex, not or only faintly curved apically in dorsal aspect .... *labiatus*-group (in part), 50. *A. pallens* Poppius

61'. Metasternal wing broader, metacoxa not extending anteriorly to level of hind margin of mesocoxal cavities; prosternal process and metasternal impression various; metatibia and metatarsomeres with micropunctation very sparse and fine or absent; male anterior protarsal claw toothed or not; stridulatory organ present or not; aedeagus various, strongly curved apically in dorsal aspect in some specimens 62

62(61). Male with a stridulatory organ consisting of a series of oblique ridges on mediolateral portion of sternum 2 and plectrum on anterior margin of metafemur; size small, body elongate and subparallel, color black except each elytron with a pair of pale sublateral spots located postmedially and subapically (visible only when elytron is lifted on some specimens); metafemur with a row of punctures along posteroventral margin; male paramere stylate .... *affinis*-group, 63

62'. Male stridulatory organ absent or file on anterodorsal edge of metafemur and plectrum formed by raised sutural line between abdominal sterna 2 and 3; size and shape various; color various but if black, without elytral spots; metafemur punctate along posteroventral margin or not; paramere strap-like or stylate 64

63(62). Elytron with sculpture fine, meshes of reticulation evidently smaller than those on disc of pronotum; male protarsus relatively narrowly dilated; aedeagus (Fig. 149A) apodeme small and with ventral margin more or less straight in lateral aspect; boreal ....57. *A. semipunctatus* (Kirby)

63'. Elytron with sculpture coarser, meshes subequal in size to those on disc of pronotum; male protarsus broadly dilated, ratio width protarsomere 1 to medial width protarsomere 5 = 2.2 to 2.5; aedeagus (Fig. 149E) with apodeme large and with ventral margin sinuate;arctic ....58. *A. velox* Leech

64(62). Male with longer metatibial spur clearly longer than metatarsomere 1, female metatibial spur subequal to or distinctly longer than metatarsomere 1; metafemur with posteroventral margin impunctate except for a few small punctures at base (occasional specimen with a small puncture distad to base) 65

64'. Longer metatibial spur subequal to or shorter than metatarsomere 1; metafemur of most specimens with a row of punctures along at least basal half of posteroventral margin 73

65(64). Elytron yellow with sutural margin and three longitudinal discal vittae, dark (vittae may coalesce on some specimens making most of elytral disc dark); ventral surface of body entirely reddish yellow to red or pterothorax dark and contrasting with pale abdomen; male anterior protarsal claw (Fig. 148A, F, K) with a small ventral tooth .... *disintegratus*-group, 66

65'. Elytron brown to piceous, without distinct longitudinal dark vittae; ventral surface of body mainly piceous to black; male anterior protarsal claw not toothed ....*aeruginosus*-group, 68

66(63). Ventral surface of body entirely red 67

66'. Ventral surface red except meso- and metasternal sclerites and metacoxal plates black ....54. *A. disintegratus* (Crotch)

67(66). Male mesotarsomere 1 short, subequal in length to combined lengths of mesotarsomeres 2 to 4; elytral sculpture consisting of very small more or less isodiametric meshes; pronotal disc dark reddish, vaguely darkened adjacent to anterior emargination; Mexico ....55. *A. gringo* new species

67'. Male with mesotarsomere 1 very large, longer than combined lengths of mesotarsomeres 2 to 4; elytral sculpture consisting of small meshes of irregular size and shape; pronotum with disc pale reddish, broadly piceous along anterior and posterior margins; eastern United States ....56. *A. taeniolatus* (Harris)

68(65). Male specimens; protarsus with protarsomeres 1 to 3 bearing oval scales ventrally; stridulatory organ present, formed from raised suture between sterna 2 and 3 and striated anterodorsal margin of metafemur 69

68'. Female specimens; protarsomeres lacking scales on ventral surface; stridulatory organ absent 71

69(68). Mesofemur and tibia each with ventral margin bearing a dense brush of yellow setae 70

69'. Mesofemora with a small group of setae at base of ventral margin otherwise without setal brush, mesotibia without setal brush .... 51. *A. punctatus* Melsheimer

70(69). Paramere (Fig. 147G) with a dense, erect apicoventral brush of setae; elytron with meshes of sculpture evidently irregular in size and shape and distinctly transverse .... 52. *A. aeruginosus* Aubé

70'. Paramere (Fig. 147J) with a row of outwardly directed hairs on ventroapical margin but setae not forming an erect brush; elytron with sculpture more regular, meshes of varied size but many meshes small and rounded, slightly transverse or in irregular transverse series .... 53. *A. xyztrus* new species

71(68). Mesotibia evidently widened from base to apex; metafemur with hind margin straight or slightly arcuate and not or only slightly produced below apical comb; palpi entirely yellow, antenna yellow except apical antennomere infuscate; sternum 6 with transverse strioles less deeply impressed, more elongate, interspaces with more or less evident transverse lines .... 51. *A. punctatus* Melsheimer

71'. Mesotibia in anterior aspect more or less parallel sided in apical half; metafemur with hind margin distinctly arcuate, posteroapical angle more or less acutely produced on most specimens; palpi infuscate apically, although lightly so on some specimens, antenna of most specimens with at least a slight darkening of distal antennomeres; sternum 6 shiny, transverse strioles shorter and deeper, interspaces with at most obsolete transverse lines 72

72(71). Elytron with sculpture fine but meshes very irregular in size and shape; smaller, length = 6.0 to 7.0 mm .... 52. *A. aeruginosus* Aubé

72'. Elytron with meshes small and irregular but generally of more similar diameters; larger, length = 6.5 to 7.8 mm ..... 53. *A. xyztrus* new species

73(64). Body dorsally yellow brown to piceous, most specimens with a greenish sheen; pronotum with lateral bead narrow, at middle about one-half maximum width of antennomere 5 or less, bead gradually narrowed onto anterolateral angle; male anterior protarsal claw (Fig. 150A, E, H, L) with a ventral tooth; aedeagus (Fig. 150C, F, J, M) in dorsal aspect with apex strongly twisted to right .... *punctulatus*-group, 74

73'. Body dorsally brown to black, without a greenish sheen; pronotum with lateral bead narrow to broad, narrowed anteriorly or not; male anterior protarsal claw with or without a ventral tooth; aedeagus with apex twisted or not 77

74(73). Both sexes with suture between sterna 2 and 3 elevated as a low, sharp ridge each side of centre, forming the plectrum of a stridulatory organ across which transverse ridges on anterodorsal margin of metafemur can be drawn; female elytral sculpture like that of male .... 62. *A. pisobius* Leech

74'. Suture between sterna 2 and 3 not raised into a ridge, metafemur lacking transverse ridges on anterodorsal margin; many females with elytron dull from fine dense reticulation 75

75(74). Male protarsus broadly dilated, ratio width protarsomere 1: median width protarsomere 5 = 2.5 to 3.1; pronotum with lateral margin more strongly rounded near posterolateral angle and discontinuous in outline with elytron; prosternal process relatively short and bluntly pointed apically; low arctic west of Hudson Bay ....60. *A. colymbus* Leech

75'. Male protarsus narrower, width protarsomere 1: width protarsomere 5 = 1.7 to 2.25; pronotum with lateral margin more evenly arcuate and more or less continuous in curvature with elytron; prosternal process more elongate and narrowly pointed apically; widespread south of arctic 76

76(75). Male anterior protarsal claw (Fig. 150A) with tooth subapical, claw broad medially and appearing asymmetrically bifid apically; aedeagus (Fig. 150C) in dorsal aspect with dorsal groove broadly open and visible to base of twisted part of apex; transcontinental ....59. *A. punctulatus* Aubé

76'. Male anterior protarsal claw (Fig. 150E) with tooth basomedial, its apex widely separated from that of claw; aedeagus (Fig. 150F) in dorsal aspect with dorsal groove lying to right side and hidden over much of its length; Washington and Oregon ......61. *A. oblongulus* Fall

77(73). Male anterior protarsal claw either with a ventral tooth or claw broad and apex obliquely truncate (Fig. 151A, H); pronotum with lateral bead broad; elytron with meshes of varied size and shape, punctures present at many intersections of lines; aedeagus (Fig. 151D, F, L) with basal apodemes very large, bulbous in lateral aspect .....*uliginosus*-group, 78

77'. Male anterior protarsal claw without a tooth; pronotum with lateral bead narrow to moderate in width; elytron with meshes small, isodiametric or irregular, lines with or without punctures at intersections; aedeagus with basal apodemes smaller 80

78(77). Pronotum with lateral bead broad, abruptly truncate behind narrow, acutely protruding front angle; male anterior protarsal claw (Fig. 151H) very broad, apex obliquely truncate ....65. *A. triton* Fall

78'. Pronotum with lateral bead evenly continued onto front angle; male anterior protarsal claw with a small to a distinct (Fig. 151A) ventral medial tooth 79

79(78). Larger, length = 6.5 to 7.6 mm; male protarsus distinctly dilated; anterior protarsal claw with a prominent ventral tooth; paramere (Fig. 151B) narrowly triangular with short setae along ventromesal margin; male with stridulatory organ of abdominal ridge and metafemoral file ....63. *A. falli* (Zimmermann)

79'. Small, length = 5.4 to 6.0 mm; male protarsus very slightly dilated, anterior protarsal claw with a small, blunt ventral tooth; paramere (Fig. 151G) strap-like, apically bearing tuft of very long, black setae; male lacking stridulatory organ ....64. *A. margaretae* Larson

80(77) Larger species, length = 6.7 to 10.2 mm; elytron with meshes rounded and more or less isodiametric 81

80’. Smaller, length = 6.0 to 6.5 mm; elytron with meshes small but very irregular in size and shape, punctures present at some intersections of lines, most evident apically . . . . *confinis*-group (in part), 88. *A. inexspectatus* Nilsson

81(80). Male protarsomeres 1 to 3 broadly dilated, protarsomere 1 approximately four times medial width of protarsomere 5; male anterior protarsal claw (Fig. 160C) short, less than one half length of posterior claw; aedeagus (Fig. 160N, O) trumpet-shaped, broadened apically with a large spade-shaped apical orifice (also keyed to couplet 89 for although the aedeagus lacks a subapical spine, the species is very similar in habitus to *A. ajax*) . . . . *fuscipennis*-group (in part), 85. *A. coxalis* Sharp

81’. Male protarsomeres narrow, protarsomere 1 less than twice medial width of protarsomere 5; protarsal claws (Fig. 162F) similar in length and shape; aedeagus (Fig. 165K, L) slender, in lateral aspect arcuate and more or less evenly narrowed to pointed apex . . . .*confinis*-group (in part), 96. *A. audeni* Wallis

82(44). Aedeagus (Fig. 163J) with subapical ventral spine very small, inconspicuous; elytron with sculpture consisting of very coarse, irregular meshes; arctic west of Hudson Bay . . . .*confinis*-group (in part), 89. *A. zetterstedti* Thomson

82’. Aedeagus with subapical spine large, conspicuous; elytron with sculpture various 83

83(82). Male protarsus broadly dilated, protarsomere 1 greater than 1.8 times medial width of protarsomere 5 84

83’. Male protarsus narrower, protarsomere 1 less than 1.8 times medial width of protarsomere 5 . . . .*confinis*-group (in part), 98

84(83). Male protarsomere 1 less than 2.5 times medial width of protarsomere 5; elytron with sculpture consisting of meshes of very irregular size and shape; arctic and western boreal . . . . *confinis*-group (in part), 85

84’. Male protarsomere 1 width various, if less than 2.5 times medial width of protarsomere 5 elytron with sculpture consisting of rounded, more or less isodiametric meshes or not occurring in arctic or western boreal regions 86

85(84). Larger, length = 7.4 to 8.1 mm; broader, length: width = 1.77 to 1.90; metatarsomere 1 with ventral accessory setae; palpi mainly yellow with apical palpomere of each palpus lightly infuscate apically; aedeagus in lateral aspect not broadened subapically (Fig. 165E, F) . . . . .97. *A. mackenziensis* Larson

85'. Smaller, length = 5.9 to 7.6 mm; narrower, length: width = 1.83 to 2.05; metatarsomere 1 without ventral accessory setae; apical palpomere of each palpus with at least apical half infuscate; aedeagus in lateral aspect broadened subapically (Fig. 164E, F) .... 91. *A. moestus* (Curtis)

86(84). Prosternum and prosternal process strongly tectiform to subcarinate, similar in convexity and more or less on same plane or at least prosternal process not evidently stepped down onto a lower plane than prosternum in lateral aspect; metatibia with a more or less complete row of separated punctures along hind margin; elytron with meshes rounded and isodiametric or if of irregular shapes, meshes small; sculpture similar on both sexes; adults not overwintering .... *fuscipennis*-group, 87

86'. Prosternal process not to distinctly stepped down from prosternum in lateral aspect, process basally less convex in cross section than prosternum medially; metatibia with hind margin impunctate or with only a few punctures along basal third to half; elytral sculpture various, sexually dimorphic with female elytron very coarsely sculptured; adult overwintering 90

87(86). Elytron with sculpture consisting of small, irregularly shaped meshes; pronotum and elytra piceous, similar in color; large, length = 9.1 to 11.0 mm .... 83. *A. fuscipennis* (Paykull)

87'. Elytron with sculpture consisting of rounded, more or less isodiametric meshes; pronotum darker than elytra or pronotum and elytra pale, yellowish to reddish brown; smaller, length = 6.6 to 10.2 mm 88

88(87). Metacoxae with intralinear space scabrous, with irregular rugae; pronotum piceous medially, broadly pale laterally, disc contrasting with paler brown or vaguely variegated elytra .... 86. *A. infuscatus* Aubé

88'. Metacoxae with intralinear space not coarsely rugose; pronotum pale to reddish brown and similar in color to elytra 89

89(88). Male protarsomere 5 (Fig. 160B) with a ventromesal tooth; protarsal claws subequal; aedeagus (Fig. 160L, M) apex acute and bearing a subapical spine; metacoxa with hind margin mesad to posterolateral emargination convexly arched in posterior aspect .... 84. *A. ajax* Fall

89'. Male protarsomere 5 (Fig. 160C) lacking ventromesal tooth; anterior protarsal claw distinctly shorter than posterior; aedeagus (Fig. 160N, O) trumpet-shaped, without a subapical spine; metacoxa with hind margin flat mesad of posterolateral emargination (see couplet 81) .... 85. *A. coxalis* Sharp

90(86). Male anterior protarsal claw toothed ventrally on most specimens(Fig. 158A - C); epipleuron entirely yellow; prosternal process narrow, more or less continuous with convexity and plane of midline of prosternum;

elytron of male with sculpture consisting of fine isodiametric meshes; female with very coarse granular sculpture, many of the meshes elongate on basal portion of disc . . . . *lutosus*-group, 91

90'. Male anterior protarsal claw not toothed; epipleuron piceous to black with at most lateral margin pale; prosternal process broader, flattened basally and strongly discontinuous in convexity and plane with median line of prosternum; male elytral sculpture consisting of irregularly sized and shaped meshes, female with lines deep and sculpture coarse but meshes not longitudinally stretched . . . . *obsoletus*-group, 93

91(90). Male anterior protarsal claw without a distinct ventral tooth or with a broad, obtuse medial angulation (Fig. 158C); large, length = 7.8 to 9.7 mm . . . . 77. *A. rumppi* Leech

91'. Male anterior protarsal claw with a large, acute, medial or subapical ventral tooth (Fig. 158A, B); length = 6.8 to 8.9 mm 92

92(91). Mesotarsomere 5 relatively short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.43 to 0.58; anterior protarsal claw (Fig. 158A) with axis of tooth directed at about 60° to axis of apex of claw; Pacific coast from southwestern British Columbia to Baja California, inland in Sierra Nevada Mountains . . . . 75. *A. lutosus* (LeConte)

92'. Mesotarsomere 5 elongate, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.58 to 0.85; anterior protarsal claw (Fig. 158B) with ventral tooth directed more apically; British Columbia and Alberta to Arizona and New Mexico, not reaching Pacific Coast . . . . 76. *A. griseipennis* LeConte

93(90). Pronotum in lateral aspect with lateral bead narrow basally and broadly expanded to anterolateral angle; aedeagus (Fig. 159J, K) with apex recurved and forming a hood over apex of subapical spine; central Sierra of California . . . . 80. *A. hoppingi* Leech

93'. Pronotum in lateral aspect with lateral bead of more or less uniform width throughout length or only slightly broadened on anterolateral angle; aedeagus with apex pointed or laterally flattened and not forming a hood over subapical spine (Fig. 159F – I, L – S); widely distributed 94

94(93). Aedeagus (Fig. 159N – S) in dorsal aspect relatively broad and abruptly narrowed apically, apex distinctly asymmetrical with apex bent to right and right apical margin more concave than left margin; widely distributed but not on Pacific Coast . . . . . *A. obliteratus* LeConte, 95

94'. Aedeagus (Fig. 159F – I, L, M) slenderer, more or less evenly narrowed from point of maximum width to apex; apex almost straight or slightly curved to right and only slightly asymmetrical; Pacific Coast from southwestern British Columbia to Baja California, and southern California to southwestern Nevada 96

95(94). Metatibia impunctate medially; eastern Oregon and California to Colorado and New Mexico . . . . 82. *A. o. obliteratus* LeConte

95'. Metatibia with mesal face densely micropunctate; eastern Oregon, Washington, and British Columbia to Manitoba, the Dakotas and Nebraska . . . . .82. *A. o. nectris* Leech

96(94). Aedeagus (Fig. 159L, M) with apical third strongly narrowed and laterally compressed; smaller, length = 5.8 to 6.7 mm; Pacific Coast, southwestern British Columbia to Oregon . . . . .81. *A. ancillus* Fall

96'. Aedeagus (Fig. 159F – I) less strongly narrowed; larger, length = 6.1 to 8.5 mm; western Oregon to Baja California and Mojave Desert 97

97(96). Larger, length = 6.5 to 8.5 mm; more robust, hind margin of pronotum distinctly bisinuate; aedeagus (Fig. 159F, G) with ventrobasal area flat; Baja California to San Francisco area, Mojave Desert . . . . .78. *A. obsoletus* LeConte

97'. Smaller, length = 6.1 to 7.3 mm; slenderer, pronotum less distinctly bisinuate; aedeagus (Fig. 159H, I) not strongly flattened on ventral surface; California, San Francisco north to southwestern Oregon . . . . .79. *A. morosus* LeConte

98(83). Prosternal process basally flat or almost so; body in dorsal aspect very narrow and parallel-sided; antenna (Fig. 163A) subserrate, outer antennomeres each with anteroapical angle slightly produced; male protarsomere 5 with a ventral tooth . . . . .87. *A. elongatus* Gyllenhal

98'. Prosternal process evidently convex throughout its length; body in dorsal aspect with lateral margins rounded and shape more oval; outer antennomeres with anteroapical angle not produced; male protarsomere 5 not toothed ventrally 99

99(98). Prosternal process carinate medially, sides adjacent to medial carina concave; size large, length = 7.8 to 9.2 mm; elytron with sculpture consisting of small, rounded, more or less equal sized meshes; pronotum black with lateral margin at most narrowly rufous . . . . .106. *A. confinis* (Gyllenhal)

99'. Prosternal process with median convexity various, low and evenly rounded to tectiform or carinate, but if carinate, elytron with meshes of sculpture distinctly irregular in size and shape; size and color various 100

100(99). Elytron with sculpture consisting of small, rounded, more or less isodiametric meshes, the principal irregularity in mesh size due to some enlarged meshes bearing a medial puncture; aedeagus in lateral aspect not broadened subapically on most specimens or broadening very gradual and indistinct 101

100'. Elytron with sculpture irregular, most specimens with meshes over much of surface of varied size and shape, some specimens with sculpture fine and regular except basomedially with a few meshes of varied size and shape apparently due to fusion of adjacent meshes; aedeagus broadened subapically (Fig. 164C, F, I) or not 105

101(100). Pronotum adjacent to lateral bead inflated near anterolateral angle, lateral bead narrowed anteriorly and on many specimens anterior portion of bead partly hidden by lateral margin of pronotum in dorsal aspect; metatarsomere 1 of many specimens with one or more accessory setae on ventral surface; male posterior protarsal claw with ventral margin sinuate but not distinctly thickened or angularly produced medially in lateral aspect; widely distributed 102

101'. Pronotum adjacent to lateral bead broadly and evenly convex along its length and not distinctly inflated towards anterolateral angle; lateral bead slightly narrowed anteriorly but clearly visible in dorsal aspect to anterolateral angle; metatarsomere 1 lacking ventral accessory setae; male posterior protarsal claw (Fig. 162I) with ventral margin strongly sinuate, medially produced as a low, broad angulation or tooth on many specimens; eastern, west to eastern edge of Great Plains . . . . .99. *A. subfuscatus* Sharp

102(101). Elytron vaguely longitudinally bicolored, outer half red to rufopiceous, medial portion piceous and similar in color to disc of pronotum; pronotum with sculpture fine, meshes small and rounded over entire surface; metatarsomere 1 of most specimens without ventral accessory setae; body rather elongate and strongly convex dorsally; width of metacoxa: width of metasternal wing = 2.5 to 3.7; length = 6.3 to 8.1 mm . . . . .98. *A. bicolor* (Kirby)

102'. Elytron paler across base than pronotum and more or less contrasting in color with pronotal disc; pronotum with sculpture various but on many specimens consisting of meshes of varied size and shape, at least medially on disc; metatarsomere 1 of most specimens with 1 or more accessory setae on ventral surface; width of metacoxa: width of metasternal wing and length various 103

103(102). Metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.2 to 4.0; pronotum with sculpture very fine and regular, meshes small and rounded over entire disc . . . . .94. *A. immaturus* Larson

103'. Metasternal wing broader, width of metacoxa: width of metasternal wing = 2.3 to 3.2; pronotum with sculpture coarser, meshes varied in size and shape, at least medially on disc 104

104(103). Pronotum with lateral margin broadly rufous, width of pale area about equal to width of anterolateral angle; metatibia with punctures of posteroventral margin extending along basal half and on many specimens continuing well into distal half . . . . . . .95. *A. canadensis* Fall

104'. Pronotum with lateral margin narrowly rufous mesad of lateral bead on most specimens; metatibia with posteroventral margin impunctate or with a few punctures along basal half . . . . . . .93. *A. phaeopterus* (Kirby)

105(100). Aedeagus in lateral aspect with shaft broadened near base of subapical spine (Fig. 164C, F, I); prosternal process with a low, broadly rounded medial convexity 106

105'. Aedeagus not broadened near base of subapical spine (Fig. 165); prosternal process various, low and broadly convex to tectiform or carinate 107

106(105). Larger species, length = 6.5 to 8.4 mm; elytron with sculpture very irregular, meshes of varied size and shape; metasternal wing broad, width of metacoxa: width of metasternal wing = 1.68 to 2.40 . . . . 90. *A. thomsoni* (J. Sahlberg)

106'. Small species, length = 5.7 to 6.7 mm; elytron with sculpture consisting of small rounded meshes of more or less similar size and shape; metasternal wing narrower, width of metacoxa: width of metasternal wing = 2.37 to 2.91 . . . . 92. *A. clypealis* (Thomson)

107(105). Prosternal process tectiform to carinate; larger species, length = 6.7 to 8.6 mm; metasternal wing broad, width of metacoxa: width of metasternal wing = 1.90 to 2.65; elytral sculpture with meshes of irregular size and shape; Cordilleran, central Alberta and British Columbia to Arizona and California 108

107'. Prosternal process various, low and evenly convex to tectiform; size various but smaller on average, length = 5.7 to 7.8 mm; width of metacoxa: width of metasternal wing various, 1.94 to 3.30; elytral sculpture various; wide distribution including arctic, boreal and Cordilleran regions 109

108(107). Male mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 less than 0.50; prosternal process carinate, sides more or less concave each side of medial ridge; color paler, elytron of most specimens pale brown to reddish brown and contrasting with black disc of pronotum; body outline more or less continuous . . . . 101. *A. approximatus* Fall

108'. Male mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 greater than 0.50; prosternal process tectiform, distinctly angulate medially with sides not excavate adjacent to medial angulation; elytron reddish brown to rufopiceous and less contrasting with dark pronotum; many specimens with lateral margin of pronotum more rounded than that of elytron thus body outline discontinuous . . . . 102. *A. kootenai* Larson

109(107). Metasternal wing relatively narrow, width of metacoxa: width of metasternal wing = 2.40 to 3.30; prosternal process of many specimens coarsely punctate and setose; pronotum with lateral margins broadly rufous, rufous area grading into dark color of disc on many specimens . . . . 100. *A. discolor* (Harris)

109'. Metasternal wing broader on average, width of metacoxa: width of metasternal wing = 1.94 to 2.80; prosternal process without coarse punctures and setae; pronotum with disc adjacent to lateral bead black or only narrowly rufous and mesal margin of rufous area sharply defined 110

110(109). Distribution, southwestern Alberta and southern British Columbia to California; elytron of most specimens with distinct punctures situated in meshes of sculpture; aedeagus of most specimens with apex distad of spine relatively long (Fig. 165T, Z) 111

110'. Transcontinental, in west south to southern British Columbia and along Rocky Mountains to Colorado; elytron with punctures small and not conspicuous on most specimens; aedeagus with apex distad of spine shorter on average (Fig. 165X) ....103. *A. inscriptus* (Crotch)

111(110). Oregon to British Columbia, east to Alberta and Wyoming; smaller, length = 6.3 to 7.3 mm; width of metacoxa: width of metasternal wing = 1.94 to 2.29; metatibia with isolated punctures along most of posteroventral margin of most specimens ....104. *A. smithi* Brown

111'. California and Nevada; larger, length = 6.6 to 8.1 mm; width of metacoxa: width of metasternal wing = 2.30 to 2.70; metatibia with posteroventral margin impunctate or with a few small punctures near base ....105. *A. sasquatch* Larson

Agabus erichsoni-group
Fig. 123

Asternus Guignot 1931*b*: 203. Type species - *Dytiscus chalconotus* Panzer 1796, by original designation.

Parasternus Guignot 1936: 186 – 188. Type species - *Agabus subtilis* Erichson 1837, by original designation.

Diagnosis. Moderate to large, length = 7.4 to 10.6 mm; color mainly black. Clypeus with anterior foveae widely separated medially and not forming a bead across anterior margin; frons with frontal punctures. Prosternal process short, metasternum with anteromedial emargination short and not reaching level of hind margin of mesocoxae. Metatibial spurs subequal in length to metatarsomere 1. Metatarsus with one to several setiferous foveae on dorsomedial portion of at least one of tarsomeres 1 to 4 (Fig. 123C). Female gonocoxa with apex dorsoventrally flattened and ridged laterally.

Comments. This group is rich in species in the Palaearctic region but only three occur in the Nearctic. The group was split into two groups by Fery and Nilsson (1993) who assigned *A. erichsoni* to the *erichsoni*-group and *A. gagates* and *A. larsoni* to the *chalconatus*-group. However, they did recognize these as sister groups. There is little to gain by this separation and because it creates the risk of losing sight of the close relationship, the species are here retained in one group, the *erichsoni*-group.

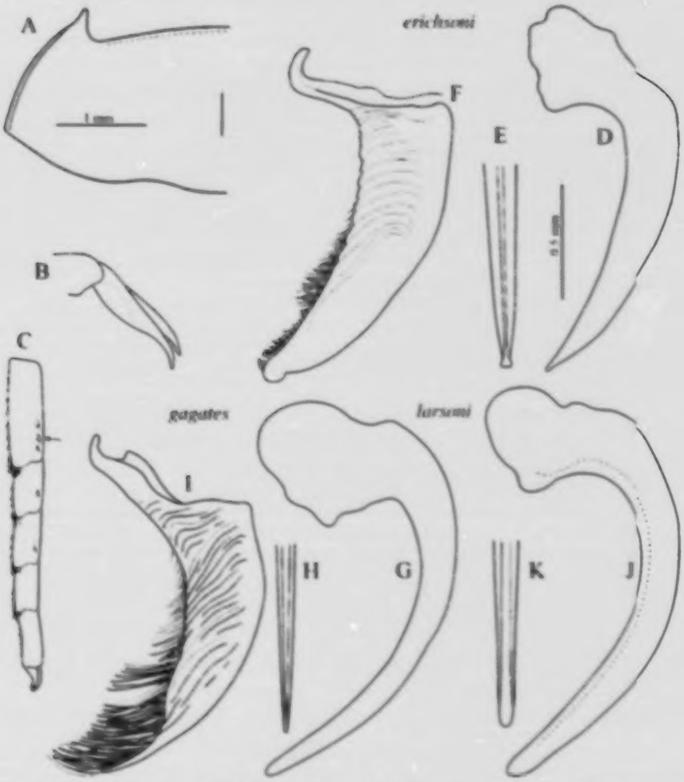


Fig. 123. *Agabus erichsoni*-group. A - F - *A. erichsoni*. A - pronotum. B - male protarsal claws, anterior. C - metatarsus, dorsal, arrow indicating dorsomedial punctures. D - aedeagus, lateral. E - aedeagus apex, dorsal. F - paramere. G - I - *A. gagates*. G - aedeagus, lateral. H - aedeagus apex, dorsal. I - paramere. J - K - *A. larsoni*. J - aedeagus, lateral. K - aedeagus apex, dorsal.

1. *Agabus erichsoni* Gemminger and Harold 1868
Fig. 123A – F

Agabus erichsoni Gemminger and Harold 1868: 454. Type locality - Berlin, Germany.

Selected References. Larson 1975: 340–341; Fery and Nilsson 1993: 101 – 103; Hilsenhoff 1993*c*: 184 – 185; Nilsson and Holmen 1995: 99 – 100; Larson 1997: 509.

Description. Length = 8.8 to 10.6 mm; width = 4.7 to 5.8 mm; length: width = 1.81 to 1.92. Large, broad and somewhat depressed species.

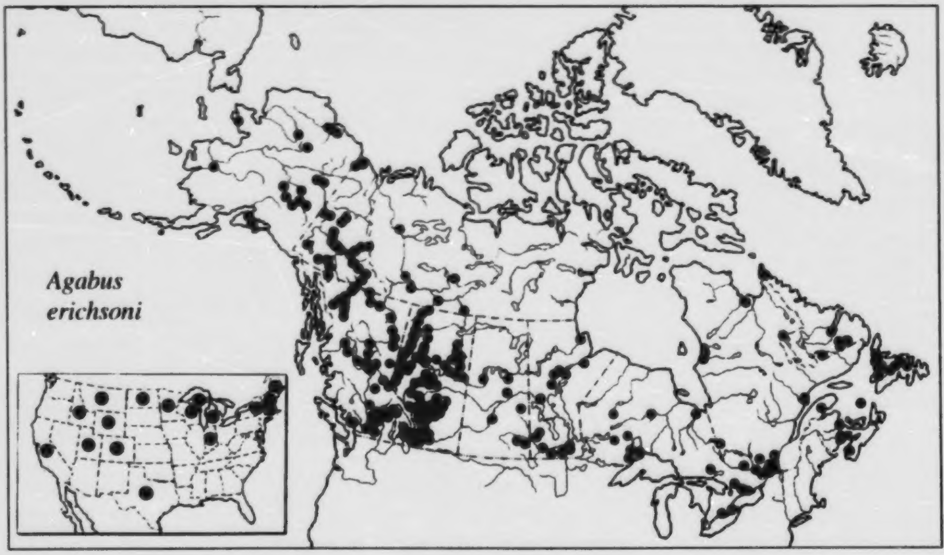
Color mainly black except head with frontal spots and anterior margin of clypeus, rufous; palpi and antenna testaceous. Pronotum with lateral margin rufous to piceous, basal margin piceous. Elytron with lateral margin rufous to piceous; epipleuron dark mesally, piceous to rufous laterally. Legs rufous to piceous or black.

Sculpture of elytron consisting of small irregularly shaped meshes with some tendency towards longitudinal stretching, less pronounced laterally and apically; microreticulation obsolete on anterior half, basomedial portion of disc with fine rugosity or microreticulation. Metacoxal plate with small, longitudinal meshes, surface finely microreticulate. Metafemur without strioles, with small punctures.

Clypeus with anterior bead broadly broken medially. Pronotum with lateral bead well defined and broad but ended behind anterolateral angle, lateral margin impressed and sinuate on anterolateral angle (Fig. 123A). Prosternal process broad and strongly convex. Metasternum with anteromedial impression short; metasternal wings broad, width metacoxa: width of metasternal wing averaging 2.14. Metatibia with a more or less complete row of punctures along posteroventral margin; medioventral face with series of smaller punctures along entire length. Metatarsomeres 1 to 3 or 4 broadly concave along outer dorsal surface of male producing a more or less distinct bead, less so on female; one or more of tarsomeres 1 to 4 with mediodorsal setiferous punctures (Fig. 123C); metatarsal claws short, broad, anterior (dorsal) claw slightly shorter and more curved than posterior.

Male protarsomeres 1 to 3 narrowly dilated, together with 8 to 10 transverse rows of small elongate adhesive setae on ventral surface; anterior protarsal claw (Fig. 123B) swollen basally, posterobasal margin with a distinct ventral sinus; slightly longer than narrow, sinuate posterior claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.53. Sternum 6 with hind margin very broadly rounded medially; ventral surface with well developed posterolateral longitudinal rugae. Aedeagus (Fig. 123D, E) short and robust, apex broadened and apically truncate in dorsal aspect; parameres (Fig. 123F) broad and strap-like, strongly rugose on outer face.

Ecology. This is a species of forested regions where it occurs amongst dense vegetation, usually *Carex*, at the margins of both temporary and permanent ponds. James (1970) reported the life history to be semivoltine with eggs overwintering the first year and adults the second. Overwintered eggs hatch early in the spring and larval development apparently occurs rapidly for teneral adults have generally been collected from mid-June to early August. However, Hilsenhoff (1993*c*) believes that in Wisconsin most individuals overwinter only as eggs with adult overwintering being less common.



Map 150. *Agabus erichsoni* Gemminger and Harold. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 150. This circumboreal species occurs from central Europe and Scandinavia to Japan and Kamtchatka and in North America from Newfoundland to Alaska and south in the west to northern Texas (male in USNM, Phantom Lake, Davis Mountains) and California.

2. *Agabus gagates* Aubé 1838

Fig. 123G – I

Agabus gagates Aubé 1838*b*: 306 - 308. Type locality - "Amerique du Nord".
Lectotype, designated by Fery and Nilsson 1993, in MNHN.

Selected References. Fery and Nilsson 1993: 96 – 98; Hilsenhoff 1993*c*: 185 – 186.

Description. Length = 7.4 to 9.1 mm; width = 4.5 to 5.1 mm; length: width = 1.58 to 1.83. Large, broad species; lateral outline of body continuous.

Color mainly piceous to black. Head with frontal spots, most of clypeus and frons above antennae and ventral surface, rufous. Antennae and palpi pale rufous, at most lightly infuscate apically. Pronotum with lateral margins broadly rufous. Elytron with lateral margins and epipleuron reddish.

Elytron with meshes of moderate, varied size and shape, lines fine, with small punctures; microreticulation obsolete basally, evident but lightly impressed apically. Metacoxal plate longitudinally strigate, microreticulate. Metatibia without strioles.

Clypeus with anterior bead incomplete, broadly broken medially. Pronotum broad, disc lowly but smoothly convex to lateral margin; lateral bead of moderate width, well defined onto anterolateral angle; lateral margin of pronotum in dorsal aspect not sinuately impressed on anterolateral angle. Elytron in lateral aspect with epipleuron almost horizontal and scarcely visible. Prosternal process short, strongly convex and tectiform medially. Metasternum with anteromedial impression short, not reaching level of hind margin of mesocoxae. Metasternal wing of moderate width, width metacoxa: width of metasternal wing = 2.40 to 2.70. Metatibia with a complete row of small, separated punctures along posteroventral margin, ventral face with sparse punctures scattered along most of length. Longer metatibial spur subequal to length of metatarsomere 1. Metatarsomeres of male similar to those of female, not impressed or concave along outer margin; at least one or more of metatarsomeres 1 to 4 with one or more punctures on dorsomesal surface; dorsal (anterior) metatarsal claw slightly shorter and more arcuate than ventral claw, claws slightly longer than length of metatarsomere 5.

Male protarsomeres 1 to 3 narrowly dilated; anterior protarsal claw slightly longer than posterior, each with a small basoventral emargination limited distally by a small denticle; mesotarsal claws with similar denticles. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.35 to 0.38. Sternum 6 evenly rounded apically, without or with a few irregular longitudinal rugae; aedeagus (Fig. 123G, H) short, length from paramere condyle to apex = 1.10 to 1.20 mm, and relatively slender, apex pointed in dorsal aspect; paramere (Fig. 123I) broad with marginal setation strong, apically with dense adhesive setae; lateral face strongly rugose.

Ecology. These beetles occur in woodland pools, generally where the water is shaded and cool, there is an accumulation of organic debris and a soft organic substrate. Specimens have been collected from spring-fed pools, beaver ponds, tire ruts and flood-water ponds along streams.

Distribution. Fery and Nilsson (1993) demonstrated that the previous concept of *A. gagates* was composite and therefore earlier distribution records are unreliable. As more narrowly defined, the range encompasses most of the United States east of the Great Plains, north to at least central New York and west to Wisconsin. Fery and Nilsson (1993) included Quebec and Alberta in the distribution (without giving more precise locality information) but all Quebec specimens examined are *A. larsoni* and the Alberta locality is almost certainly in error. There are no definite Canadian records but as the species is known from close to the Canadian border, its occurrence in eastern Canada is possible.

3. *Agabus larsoni* Fery and Nilsson 1993

Fig. 123J, K

Agabus larsoni Fery and Nilsson 1993: 98. Type locality - Cap de la Madeleine, Quebec. Type in Museum für Naturkunde der Humboldt-Universität, Berlin.

Description. Length = 7.9 to 10.0 mm; width = 4.4 to 5.2 mm; length: width = 1.74 to 1.86. Very similar to *A. gagates*, separable mainly on shape of aedeagus.

Color mainly black. Head with frontal spots, most of clypeus and frons above base of antennae, rufous; antenna with at least antennomere 11 slightly infuscate apically. Pronotum with lateral margins rufous. Elytron piceous, lateral margin and epipleuron rufescent. Ventral surface mainly piceous to black. Legs reddish.

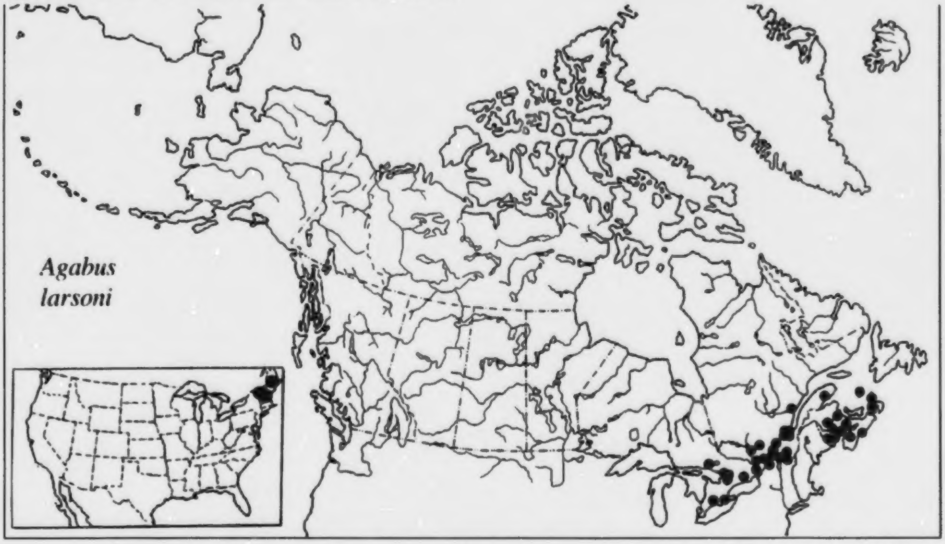
Elytron with moderate meshes of irregular size and shape, less regular basomedially than in *A. gagates* and with some meshes fused to form elongated, sinuate meshes; lines with small punctures; microreticulation effaced basally, shallow but evident apically. Metacoxal plate with longitudinal strigae, microreticulate. Metatibia without strioles.

Clypeal bead broadly broken medially. Pronotum with lateral bead well defined throughout length but narrower than in *A. gagates;* lateral margin not impressed or sinuate on anterolateral angle; posterolateral angle obtuse, base more or less evenly arcuate except faintly emarginate each side of medial lobe. Metasternal wing relatively narrow, width metacoxa: width of metasternal wing = 2.45 to 3.00. Metatarsomeres 1 to 4 with mediodorsal setiferous punctures; anterior metatarsal claw narrower and slightly more curved apically than posterior claw.

Male protarsomeres 1 to 3 slightly broadened, ventrally bearing transverse rows of narrow adhesive setae; anterior protarsal claw slightly longer than posterior, ventrally with a small subbasal denticle, posterior claw with a small submedian denticle. Mesotarsal claws with similar denticles. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.32 to 0.38. Male sternum 7 evenly rounded apically; rugae obsolete or absent. Aedeagus (Fig. 123J, K) long, length from paramere condyle to apex = 1.28 to 1.35 mm, and relatively robust with apex rounded in lateral aspect; paramere relatively broad with marginal setation strong, distally setae strong and adhesive; outer face strongly rugose.

Ecology. Very similar to *A. gagates* in that specimens have generally been collected from small, cold woodland pools, usually where there is moss and accumulation of plant debris such as grass or sedge stalks or fallen leaves. Specimens have also been collected from small, peat-rich springs.

Distribution. Map 151. Because this species has only recently been segregated from *A. gagates*, it is not possible to determine the range of either species from literature records. Specimens have been examined from eastern Canada, Nova Scotia to Ontario, and northern New England states of the United States. It is likely that all records of *A. gagates* from Canada refer to this species.



Map 151. *Agabus larsoni* Fery and Nilsson. Canadian and Alaskan collection localities and United States state records.

Agabus opacus-group

Figs. 124 – 128

Diagnosis. Small to large (length = 5.3 to 11.2 mm) piceous to black species, elytron with or without a pale sublateral spot; shape ovate to elongate-oval; many specimens with evident discontinuity in lateral outline between pronotum and elytron. Elytral sculpture various but most specimens with punctures visible at intersections of meshes. Clypeus with anterior bead incomplete medially; frons with frontal punctures present or absent. Prosternal process short, metasternum with anteromedial impression short and not reaching level of hind margin of mesocoxae; metatibia slender, with a row of separated punctures along posteroventral margin; length of longer metatibial spur various, 0.55 to 1.10 length of metatarsomere 1; metatarsomeres lacking dorsal punctures. Male protarsal claws without ventral tooth. Female gonocoxite sclerotized, laterally flattened basally but with a longitudinal lateral ridge and apex dorsoventrally flattened.

Comments. This is a Holarctic group but it attains maximum diversity in western North America. The externally ridged female gonocoxa indicates a relationship with the *erichsoni*-group. North American members of the group were revised by Larson (1996).

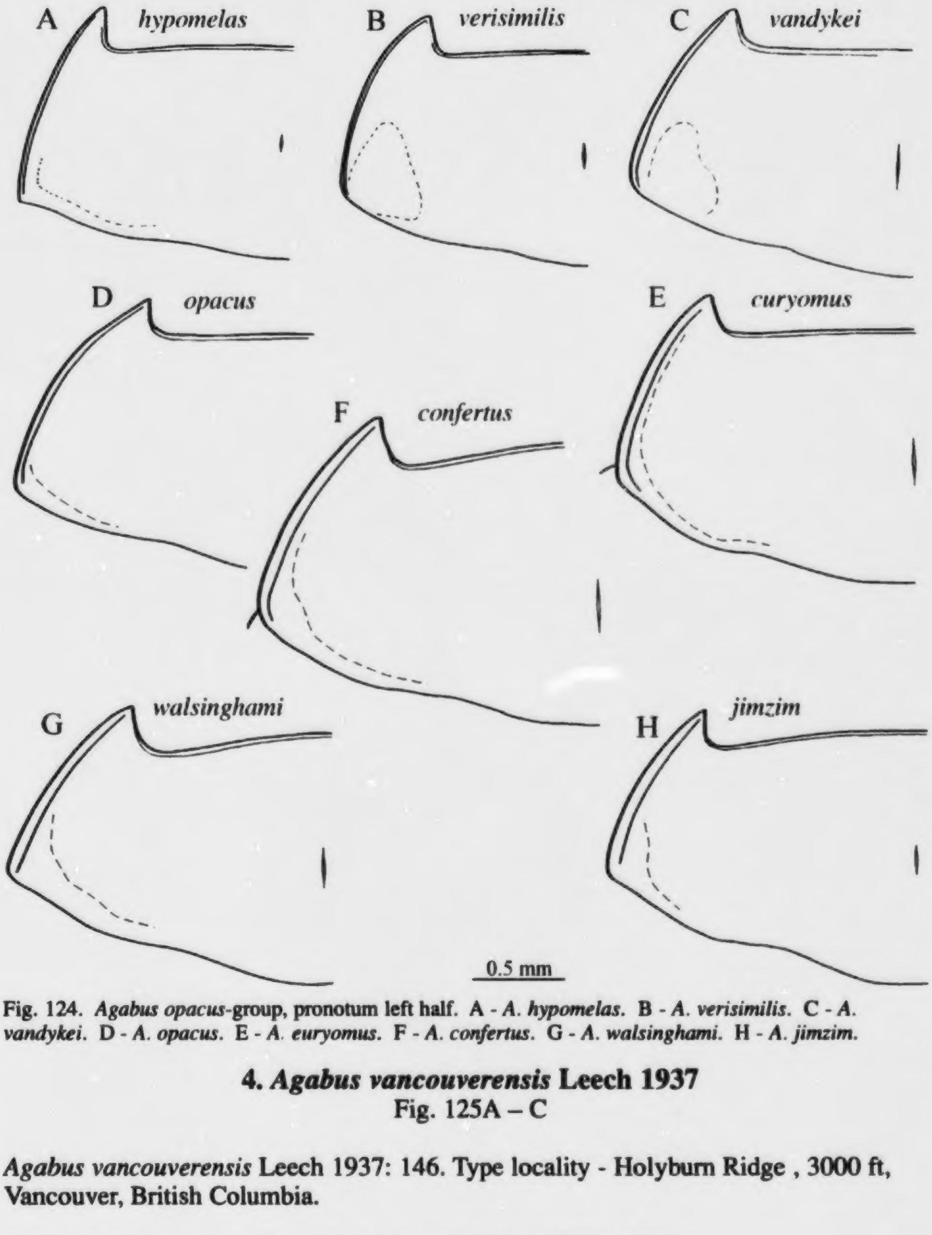

A
hypomelas
B
verisimilis
C
vandykei
D
opacus
E
euryomus
F
confertus
G
walsinghami
H
jimzim
0.5 mm

Fig. 124. *Agabus opacus*-group, pronotum left half. A - *A. hypomelas*. B - *A. verisimilis*. C - *A. vandykei*. D - *A. opacus*. E - *A. euryomus*. F - *A. confertus*. G - *A. walsinghami*. H - *A. jimzim*.

4. *Agabus vancouverensis* Leech 1937

Fig. 125A – C

Agabus vancouverensis Leech 1937: 146. Type locality - Holyburn Ridge , 3000 ft, Vancouver, British Columbia.

Selected References. Leech 1945: 77–78; Larson 1996*b*: 621.

Description. Length = 7.1 to 9.0 mm, width = 3.6 to 4.6 mm, length: width = 1.88 to 2.09. Moderate sized species of elongate, subparallel shape.

Color mainly black. Head dorsally with labrum, anterior margin of clypeus, frons above antennal insertions and frontal spots rufous; antenna pale with at least apical

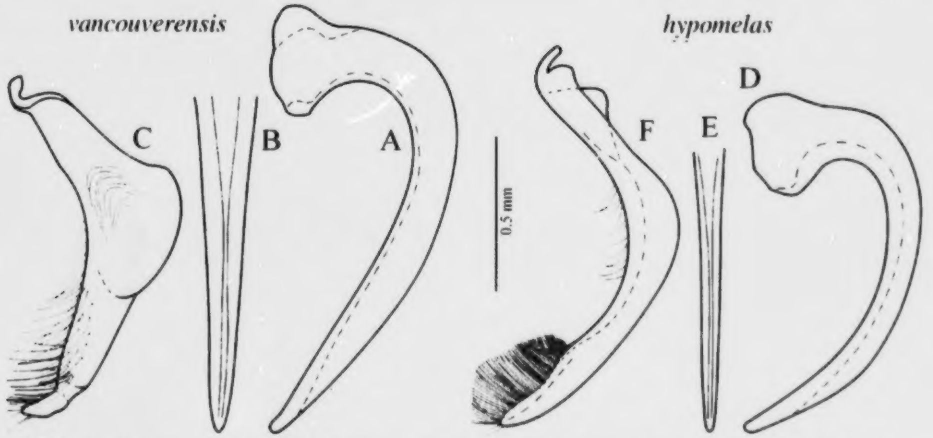


Fig. 125. *Agabus opacus*-group, male genitalia. A - C - *A. vancouverensis*. A - aedeagus, lateral. B - aedeagus, dorsal. C - paramere. D - F - *A. hypomelas*. D - aedeagus, lateral. E - aedeagus, dorsal. F - paramere.

antennomere infuscate, most specimens with several apical antennomeres infuscate; palpi pale with apical palpomere of each palpus infuscate. Pronotum with lateral margin rufous, pale area covering most of anterolateral angle, then narrowing to posterolateral angle. Elytra piceous to black medially, gradually paler laterally, lateral margin basally brown, without a sublateral pale spot; epipleuron piceous medially, broadly brown laterally. Ventral surface mainly piceous to black, with proepipleuron laterally, prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous to rufopiceous.

Sculpture similar in both sexes. Elytron with lines fine, meshes varied in size, polygonal in shape, most intersections with a distinct puncture but depth of punctures somewhat varied, medially meshes smooth or with variously effaced reticulation, reticulation stronger apically and laterally, reticulation also somewhat varied in size and shape and integrating with primary sculpture on shoulder and apically on some specimens. Metacoxal plate with lines fine, meshes irregular, strongly longitudinally stretched laterally and posteriorly; with irregular transverse rugae. Metafemur finely and sparsely punctate, without strioles.

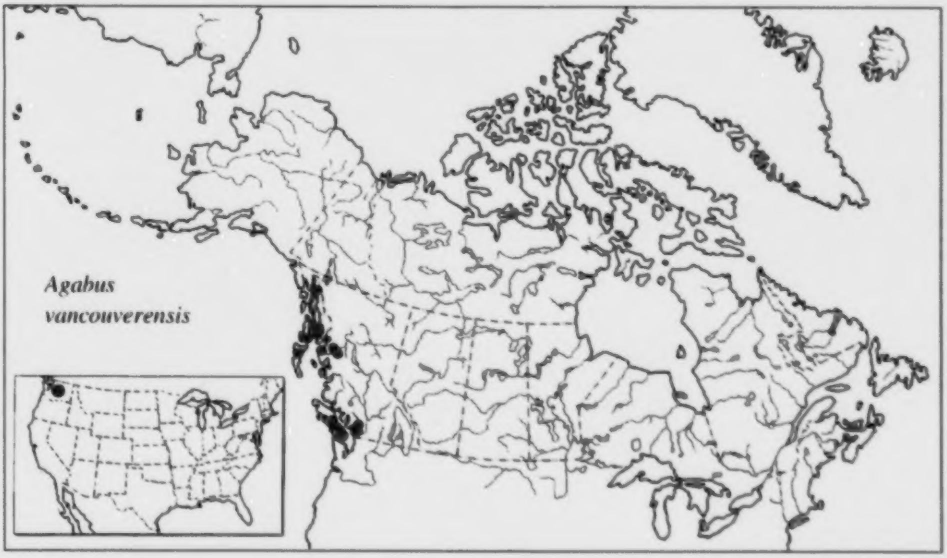
Clypeus with anterior bead broadly broken medially but with clearly separated submarginal punctures medially; frons lacking frontal punctures. Pronotum with lateral bead narrow, at widest point 0.18 to 0.25 maximum width of a medial antennomere, narrowed on anterolateral angle; disc mesad to bead convex, most noticeably so anteriorly; lateral margin arcuate anteriorly, becoming more or less straight and parallel-sided posteriorly; posterolateral angle slightly produced, right angled to slightly acute; hind margin almost truncate, very feebly emarginate each side of scutellum; in lateral aspect lateral margin straight or slightly arcuate near hind angle, proepipleuron visible below lateral margin in anterior half. Elytron in lateral aspect with lateral margin broadly and evenly arcuate, epipleuron disappearing shortly behind shoulder.

Prosternum medially broadly tectiform, with a distinct medial convexity; process basally in same plane as prosternum, but apex on most specimens deflected slightly upwards; process short, cordate, pointed apically, lateral bead narrow, broken narrowly at apex; surface broadly and smoothly convex, without sign of median angulation except at apex, surface punctate, with short brown setae. Metasternal impression short, extending slightly behind middle of level of mesocoxal cavities. Metasternal wings moderately broad, width metacoxa: width of metasternal wing = 2.24 to 3.16. Hind legs slender, metafemur length: width = 3.56 to 3.86; metatibia slender, posterior margin with irregularly spaced, separated punctures along most of length; ventral face with a few large scattered punctures, most specimens with one or two punctures distally of middle; metatibial spurs short, length of spur: length of metatarsomere 1 = 0.62 to 0.76.

Male protarsomeres 1 to 3 very slightly dilated, protarsal ratio = 1.40: 1.40: 1.26: 1.12: 1; each tarsomere with small adhesive scales ventrally; protarsal claws little modified, anterior claw slightly broader than posterior, its ventral margin slightly sinuate on some specimens. Mesotarsi of average length, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46 to 0.54. Metatarsomeres 1 to 3 with ventral swimming hairs. Aedeagus (Fig. 125A, B) simple, in lateral aspect curved basally, straighter apically, apex rounded; in dorsal aspect gradually narrowing from base to bluntly pointed apex; paramere (Fig. 125C) with basal sclerite triangular, apical portion elongate, setose ventromesally and with apex sclerotized.

Ecology. This species occurs in higher elevations, from near tree line to alpine sites, along the Pacific coast. Specimens occur in small silt to gravel bottomed permanent ponds and lakes.

Distribution. Map 152. This species occurs along the Pacific Coast from Alaska to Washington and on coastal islands. No specimens have been seen inland from the Coast range.



Map 152. ***Agabus vancouverensis*** **Leech. Canadian and Alaskan collection localities and United States state records.**

5. *Agabus hypomelas* Mannerheim 1843

Fig. 124A, 125D – F

Agabus hypomelas Mannerheim 1843: 221. Type locality - Sitka Island, Alaska.

Selected References. Leech 1937: 148 – 149; Leech 1945*a*: 77–78; Biström 1987: 35 (location of syntypes of *A. hypomelas*); Larson 1996*b*: 623 – 626.

Description. Length = 5.8 to 7.5 mm; width = 3.0 to 3.9 mm; length: width = 1.83 to 2.06. Size small, shape various but most specimens evidently elongate and subparallel.

Color dark brown or rufopiceous to black (recently collected specimens generally much darker in color than old specimens which have probably been bleached in preservation, description applies to fresh specimens), some specimens with a faint brassy reflection. Head dorsally with labrum, most of clypeus, frons above antennal insertions and frontal spots, rufous; antenna yellow except at least antennomere 11 infuscate apically, many specimens with apical 3 or 4 antennomeres infuscate apically; palpi pale without infuscation. Pronotum with lateral margin broadly rufous, rufous area encompassing anterolateral angle, narrowing posteriorly to posterolateral angle. Elytra dark rufous to piceous medially, gradually paler laterally, lateral margin broadly reddish brown, without a sublateral pale spot; epipleuron rufous laterally, infuscate mesally. Ventral surface mainly piceous to black with proepipleuron, prosternum anteriorly, prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous with femora and metatibia darkened.

Sculpture similar on both sexes. Elytron with lines fine, meshes varied in size, polygonal in shape, each intersection with a conspicuous puncture, medially meshes smooth or with faint rudiments of reticulation, reticulation stronger apically but not obscuring punctures. Metacoxal plate with lines fine, meshes irregular, strongly longitudinally stretched laterally and posteriorly; with irregular transverse rugae. Metafemur finely and sparsely punctate, without strioles.

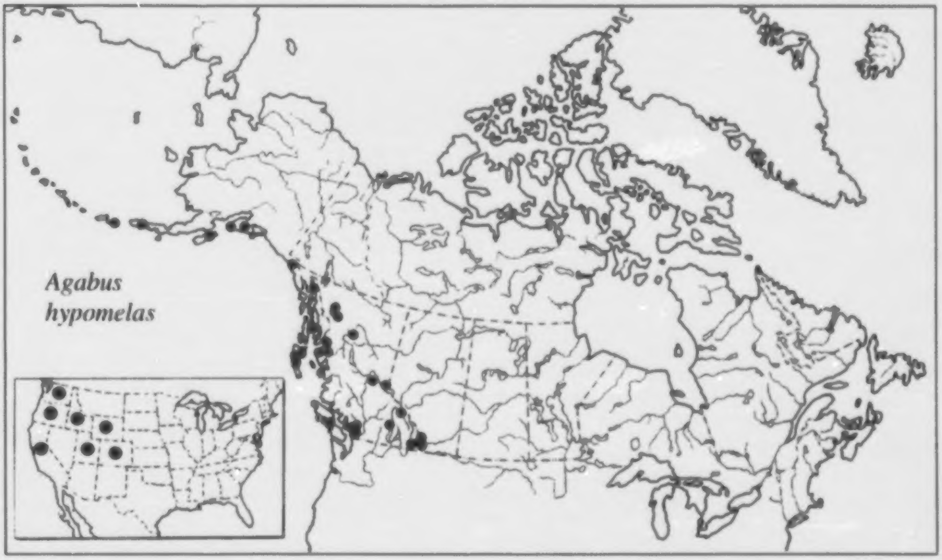
Clypeus with anterior bead broadly broken medially, some specimens with clearly separated submarginal punctures medially; frons with frontal punctures present. Antenna relatively short and stout but shape varying geographically. Pronotum (Fig. 124A) with lateral bead narrow, at widest less than 0.33 maximum width of medial antennomere, bead narrowed on anterolateral angle, disc mesad to bead convex, most noticeably so anteriorly; in dorsal aspect most specimens with lateral margin more or less straight and sides subparallel in basal half but some specimens with sides more or less smoothly arcuate; posterolateral angle about right angled or slightly produced; hind margin very broadly and slightly arcuate, feebly emarginate each side of middle; pronotum in lateral aspect with lateral margin straight or slightly arcuate near hind angle, proepipleuron visible below lateral margin in anterior half. Elytron in lateral aspect with lateral margin broadly and evenly arcuate, epipleuron disappearing shortly behind shoulder.

Prosternum medially broadly tectiform, with a distinct medial convexity; process basally in same plane as prosternum but apex on most specimens deflected slightly upwards; process short, cordate and pointed apically, lateral bead narrow; surface broadly and smoothly convex to distinctly angulate medially especially apically, lateral surface punctate with short brown setae. Metasternum with anteromedial projection narrowly separating mesocoxae, with a small, deep impression for reception of apex of prosternal process but not extending as far posterad as level of hind margin of mesocoxae. Metasternal wings moderately broad, width metacoxa: width of metasternal wing = 2.07 to 3.20. Hind legs slender, metafemur length: width = 3.03 to 3.50; metatibia slender, posterior margin with irregularly spaced, separated punctures along most of length; ventral face with a few large scattered punctures, most specimens with one or two punctures apically of middle; metatibial spurs short, length of spur: length of metatarsomere 1 = 0.65 to 0.75.

Male protarsomeres very slightly dilated, protarsal ratio = 1.40: 1.40: 1.30: 1.15: 1; protarsomeres 1 to 3 ventrally with small adhesive scales; protarsal claws little modified, anterior claw slightly broader than posterior, its ventral margin slightly sinuate on some specimens. Mesotarsi of average length, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46 to 0.54. Metatarsomere 1 with ventral swimming hairs. Paramere (Fig. 125F) consisting of an elongate, sclerotized strap with apex bearing two longitudinal brushes of adhesive setae on ventral margin, ventral margin mesally with sparse, simple setae; aedeagus (Fig. 125D, E) weakly sclerotized, yellow, in lateral aspect gently arcuate, slightly widened subapically, not curved in dorsal aspect.

Ecology. This species occurs from sea level in Alaska and northwestern British Columbia to about 2000 m on Mt. Rainier, Washington and 3000 m in Colorado. Most specimens have been collected from small, mossy, spring-fed pools in either coniferous forest or in stands of willow or alder.

Distribution. Map 153. The range extends along the Pacific Coast from the Aleutian Islands, Alaska, to northern California (Siskiyou Co.) and inland to the Rocky Mountains of Alberta and Colorado.



Map 153. *Agabus hypomelas* Mannerheim. Canadian and Alaskan collection localities and United States state records.

6. *Agabus verisimilis* Brown 1932

Figs. 124B; 126A – C

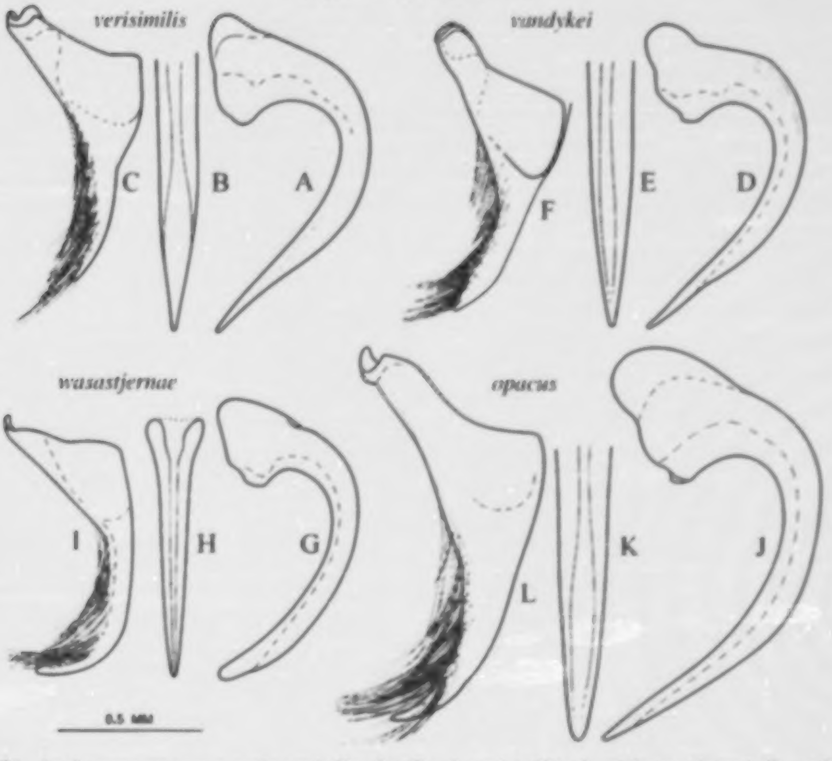


Fig. 126. *Agabus opacus*-group, male genitalia. A – C - *A. verisimilis*. A - aedeagus, lateral. B - aedeagus, dorsal. C - paramere. D – F - *A. vandykei*. D - aedeagus, lateral. E - aedeagus, dorsal. F - paramere. G – I - *A. wasastjernae*. G - aedeagus, lateral. H - aedeagus, dorsal. I - paramere. J – L - *A. opacus*. J - aedeagus, lateral. K - aedeagus, dorsal. L - paramere.

Agabus verisimilis Brown 1932*a*: 4. Type locality - Creston, British Columbia. Type in CNC.

Selected References. Leech 1942*b*: 130; Hatch 1953: 226; Anderson 1962: 70; Larson 1975: 339; Larson 1996*b*: 626 – 628.

Description. Length = 6.1 to 7.3 mm; width = 3.2 to 3.7; length: width = 1.78 to 2.04. Small species.

Color mainly piceous to black. Head with labrum, anterior margin of clypeus and a pair of large frontal spots, rufous; antenna yellow except apical antennomere lightly infuscate apically on some specimens; palpi yellow without infuscation. Pronotum with lateral bead translucent, disc with convex area mesad to bead, rufous and rather sharply delimited mesally from dark area of disc. Elytron dark rufous to piceous medially, lateral margin slightly paler on some specimens, without a sublateral pale spot; epipleuron piceous mesally, outer margin paler. Ventral surface with proepipleuron anteriorly, metacoxal processes and posterior margin of sterna 3 to 6, rufous. Legs rufous with femora medially and metatibia darker.

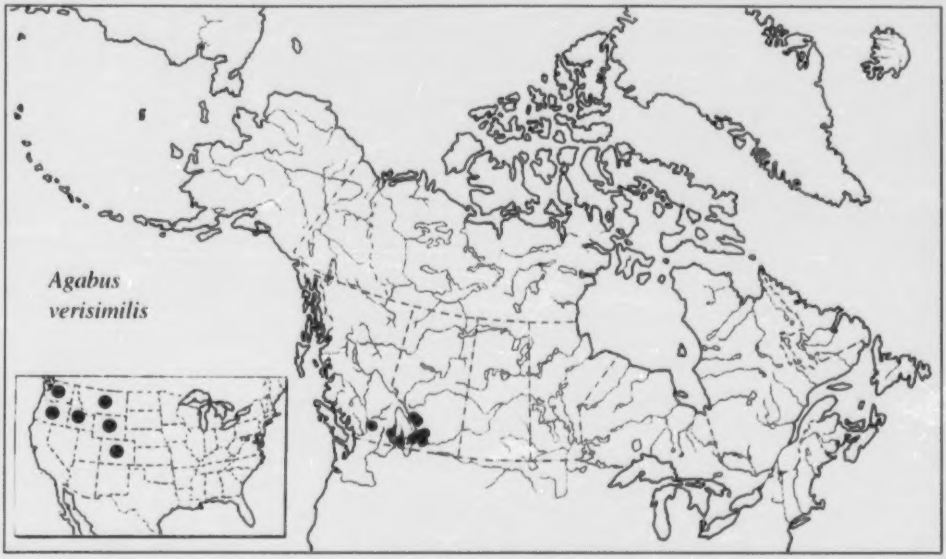
Elytron with fine lines forming small, irregular polygonal meshes; lines with a small puncture at most intersections, larger punctures present on some meshes; meshes with fine reticulation which is variously effaced medially and laterally on disc, more so on male than female, but well developed at apex.

Frons lacking frontal punctures. Antenna slender. Pronotum (Fig. 124B) with lateral bead narrow, about one-third maximum width of a median antennomere, sharply delimited from convexly elevated lateral portion of disc; lateral margin broadly and evenly arcuate throughout length, posterolateral angle obtuse and somewhat rounded and making lateral margin of body somewhat discontinuous; hind margin broadly rounded except for a broad emargination each side of scutellum; proepipleuron visible in lateral aspect as an elongate triangle below anterior angle. Prosternum and its process in more or less same plane in lateral aspect, each with a distinct medial longitudinal convexity; prosternal process short, bluntly pointed, received into a short impression on metasternum, laterally with conspicuous erect setae, lateral bead narrow. Metasternum with anteromedial process narrow, impression shallow, short, not or only slightly extending posteriorly beyond level of middle of mesocoxae; metasternal wing very broad, width metacoxa: width of metasternal wing = 1.71 to 2.06. Hind legs slender, metafemur length: width = 3.10 to 3.55; metatibia slender, posterior margin with one to several irregularly placed coarse punctures along hind margin, generally near middle, also some specimens with a few additional fine punctures near base and middle; ventral face with a row of small, separated punctures in basal half; metatibial spurs short, length of longer spur: length of metatarsomere 1 = 0.63 to 0.74.

Male protarsomeres narrowly dilated, width protarsomere 1 = 0.13 to 0.16 mm, protarsal ratio = 1.57: 1.47: 1.31: 1.14: 1; protarsomeres 1 to 3 each with a cluster of small adhesive yellow setae beneath; protarsal claws slender, subequal in length, anterior claw gradually and evenly narrowed to apex, posterior claw with a slight ventral sinuation. Mesotarsomere 5 short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.47 to 0.53. Metatarsomere 1 with ventral swimming hairs. Abdominal sternum 6 slightly flattened medially, laterally with a few poorly defined longitudinal rugae. Male genitalia with paramere (Fig. 126C) narrowly triangular, with an oval basal sclerite and an elongate apical stylus which bears setae on ventral and mesal surfaces; aedeagus (Fig. 126A, B) slender, in lateral aspect with ventral margin almost straight or slightly recurved in apical half, dorsal margin sinuately narrowed apically; in dorsal aspect shaft straight, evenly narrowed in apical third.

Ecology. These insects occur in small, cold, permanent, spring-fed pools in the subalpine zone of mountainous regions. Altitudinal records range from 1500 to 3200 m. Most specimens have been collected from small, spring-fed pools in coniferous forests but specimens have also been found in pools along forest edges and in willow swamps. The pools generally have mossy edges, soft peat bottoms and may be shaded by *Carex*.

Distribution. Map 154. The range extends along the Rocky Mountains from southwestern Alberta to Colorado and west to south central British Columbia and eastern Oregon.



Map 154. *Agabus verisimilis* Brown. Canadian and Alaskan collection localities and United States state records.

7. *Agabus vandykei* Leech 1942

Fig. 124C, 126D – F

Agabus vandykei Leech 1942*b*: 129 – 130. Type locality – Yosemite, California. Holotype – male in CASC.

Selected References. Leech and Chandler 1956: 320; Larson 1996*b*: 628 – 629.

Description. Length = 5.8 to 7.0 mm; width = 3.0 to 3.9 mm; length: width = 1.81 to 2.00. A small species, very similar to *A. verisimilis*, differing primarily in characters given in the key to species.

Color mainly rufopiceous to black. Head with labrum, anterior margin of clypeus and a pair of large frontal spots, rufous; antenna yellow except some specimens with apical antennomere infuscate apically; palpi yellow without infuscation. Pronotum with lateral bead translucent, convex margin of disc mesad to bead, rufous. Elytron piceous medially, lateral margin dark rufous to piceous, without a sublateral pale spot; epipleuron piceous mesally, outer margin paler. Ventral surface with proepipleuron, prosternal process, metacoxal processes and posterior margin of sterna 3 to 6, rufous. Legs rufous with femora medially and metatibia darker.

Elytron with fine lines forming small, irregular polygonal meshes; most intersections of lines with a puncture, punctures of varied size basomedially, more regular apically; some meshes also with a medial puncture; meshes with fine reticulation which is variously effaced medially on disc, stronger and more regular laterally and apically, some females dull due to strongly developed microreticulation over entire upper surface of body. Metasternal wing with dense transverse lines. Metacoxal plate microreticulate, meshes transverse anteriorly, more or less isodiametric medially and longitudinal posteriorly; surface with shallow transverse grooves and narrow, anastomosing strioles. Metatibia without strioles, finely punctate.

Frons lacking frontal punctures. Antenna slender. Pronotum (Fig. 124C) with lateral margin broadly rounded anteriorly, less so posteriorly, posterolateral angle narrowly obtuse and lateral outline of body more or less continuous; hind margin with a shallow emargination each side of scutellum, broadly and evenly arcuate laterad of this; disc with a shallow broad impression near each posterolateral angle, impression separated from lateral margin by a slightly convex area; proepipleuron narrowly visible in lateral aspect below anterior angle. Prosternum and its process in more or less same plane in lateral aspect, each with a distinct medial longitudinal convexity, prosternal process short, variously setose. Metasternum with anteromedial impression shallow, short, extending posteriorly only shortly beyond level of middle of mesocoxae; metasternal wing broad, width metacoxa: width of metasternal wing = 1.87 to 2.23. Hind legs slender, metafemur length: width = 3.13 to 3.38; metatibia slender, posteroventral margin with one to 10 punctures of varied sizes, generally coarsest punctures near middle and finer punctures basally although punctures erratically distributed on some specimens, punctures generally clearly separated; ventral surface with a row of small, separated punctures in basal half; metatibial spurs short, length of longer spur: length of metatarsomere 1 = 0.69 to 0.82.

Male protarsomeres narrowly dilated, width of protarsomere 1 = 0.14 to 0.15 mm, protarsal ratio = 1.52: 1.43: 1.24: 1.10: 1; protarsomeres 1 to 3 each with a cluster of small adhesive yellow setae beneath; protarsal claws slender, subequal in length, anterior claw slightly broader basally, posterior claw with ventral margin slightly concave ventrally making ventral margin slightly sinuate. Mesotarsomere 5 short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46 to 0.51. Metatarsomere 1 with ventral swimming hairs. Abdominal sternum 6 slightly flattened medially, laterally with a few fine longitudinal rugae or longitudinally confluent punctures. Male genitalia (Fig. 126D - F) with paramere narrowly triangular, with an oval basal sclerite and an elongate apically stylus which bears setae on ventral and mesal surfaces; aedeagus slender, in lateral aspect with ventral margin almost straight or slightly recurved in apical half, dorsal margin sinuately narrowed apically; in dorsal aspect shaft straight, evenly narrowed in apical third.

Ecology. The habitat has not been recorded. Altitude records range from about 1100 to 3700 m. Like *A. verisimilis*, the species probably occurs in small, cold, spring-fed pools.

Distribution. This species occurs in the Sierra Nevada Mountains of California, north to southern and possibly northwestern Oregon.

8. *Agabus wasastjernae* (C. R. Sahlberg 1824)

Fig. 126G – I

Dytiscus wasastjernae C. R. Sahlberg 1824: 167. Type locality - Wasa, Finland. Holotype examined by Larson and Nilsson 1985: 126.

Selected References. Larson 1975: 338–339; Larson and Nilsson 1985: 126; Hilsenhoff 1993*c*: 190; Nilsson and Holmen 1995: 93 – 94; Larson 1996*b*: 629 – 631; Larson 1997*b*: 511.

Description. Length = 5.3 to 6.7 mm; width = 2.8 to 3.6 mm; length: width = 1.83 to 2.05. Smallest species of group.

Color mainly piceous to black. Head with anterior margin of clypeus and a pair of large frontal spots, rufous; antenna and palpi pale rufous, without apical infuscation. Pronotum with lateral bead and hind margin translucent, disc mesad to lateral bead narrowly rufous to piceous. Elytron with lateral margin piceous, at least apically, without a sublateral pale spot; epipleuron piceous. Ventral surface dark rufous to piceous with metacoxal processes and hind margins of sterna 3 to 6, rufous. Legs rufous with femora and metatibia darkened.

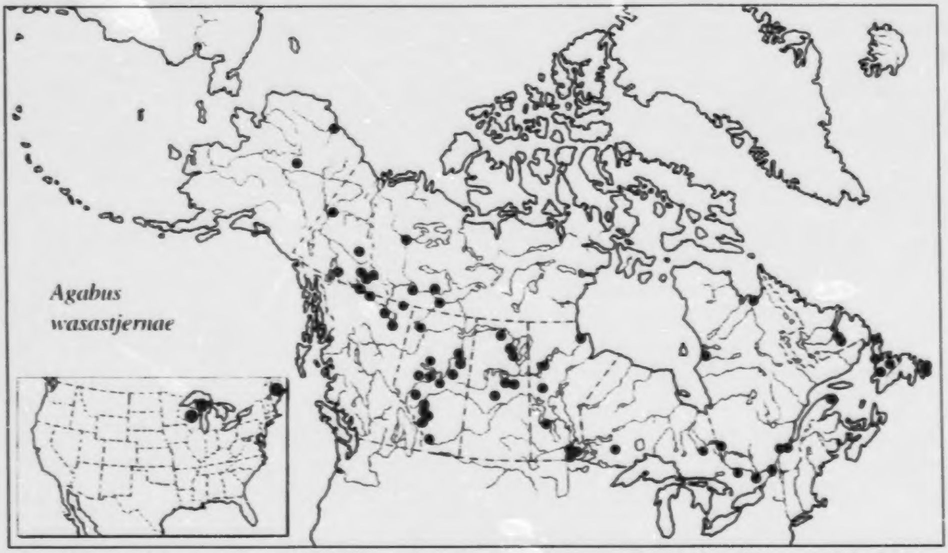
Elytron with lines of sculpture fine, forming moderate sized meshes of varied polygonal shape; intersections with fine punctures, also larger punctures in some meshes; meshes with fine isodiametric reticulation which may be variously effaced medially; some females with basal meshes slightly longitudinally stretched. Metasternum with dense transverse lines and meshes. metacoxal plate finely reticulate, meshes not strongly stretched; with a few faint anastomosing lines and transverse rugae.

Frons lacking frontal punctures. Antenna slender. Pronotum broad and rather strongly convex, sides broadly rounded in basal half, straighter and convergent anteriorly; posterolateral angle narrowly rounded and obtuse, basal margin smoothly convex laterally, slightly emarginate each side of scutellum; lateral bead of moderate width, about one-half maximum width of a medial antennomere, sharply limited, of more or less even width throughout length or slightly narrowing anteriorly; disc mesad of bead smoothly and continuously convex with middle of pronotal disc, posterolateral impression weak or obsolete. Proepipleuron narrowly visible below lateral bead in lateral aspect. Prosternum and its process angularly convex medially; prosternal process short, in lateral aspect slightly deflected upwards from midline of prosternum; tectiform in cross-section, sparsely setose laterally. Metasternum with anteromedial impression short, extending only slightly past level of middle of mesocoxae; metasternal wings moderately narrow, width metacoxa: width of metasternal wing = 2.33 to 3.06. Metatibia of moderate width, metafemur length: width = 3.00 to 3.33; metatibia with an irregular series of punctures along posteroventral margin; ventral face impunctate except for a few punctures at base; metatibial spur short, length of longest spur: length of metatarsomere 1 = 0.55 to 0.74.

Male protarsi narrowly dilated, width protarsomere 1 = 0.11 to 0.14 mm; protarsal ratio = 1.53: 1.44: 1.29:1.12: 1; protarsomeres 1 to 3 each with a small group of adhesive setae ventrally; protarsal claws slender, subequal in length and similar in shape. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46 to 0.53. Metatarsomere 1 with ventral swimming hairs. Sternum 6 flattened medially, laterally finely sculptured, punctures distinct and at most with faint longitudinal rugae. Paramere (Fig. 126I) with basal sclerite small, apical stylus very long; aedeagus (Fig. 126G, H) slender in lateral aspect, of more or less uniform width throughout most of length, bluntly rounded apically; in dorsal aspect slender and evenly narrowing to pointed apex.

Ecology. These insects have a wide distribution in the boreal zone. Most specimens have been collected from small sphagnum ringed pools, usually in, or adjacent to, forest. In Newfoundland all records are from forest or forest edge pools, none have been collected from pools in the extensive open bogs and fens. Specimens have also been found amongst hummocks and moss in *Carex* marshes. The larva has been described by Nilsson (1982*a*).

Distribution. Map 155. This Holarctic species occurs more or less throughout the boreal zone of the Nearctic and Palaearctic regions. The North American range extends from Newfoundland to Alaska.



Map 155. *Agabus wasastjernae* (Sahlberg). Canadian and Alaskan collection localities and United States state records.

9. *Agabus opacus* Aubé 1837

Figs. 124D; 126J – L

Agabus opacus Aubé 1837: 173. Type locality - Finland.

Selected References. Zaitzev 1953: 232; Larson 1975: 337; Nilsson 1984*b*: 492 – 494; Larson and Nilsson 1985: 125; Nilsson and Holmen 1995: 94 – 95; Larson 1996*b*: 631 – 633; Larson 1997*b*: 510.

Description. Length = 7.1 to 8.6 mm; width = 3.8 to 4.4 mm; length: width = 1.79 to 1.93. A moderately large, robust species, length: width not differing between sexes but densely sculptured females with point of maximum width more posterad than on males and male-like females.

Color mainly black. Head with clypeus anteriorly, frons above antennal base and large frontal spots, rufous; palpi and antennae rufous, without apical infuscation. Pronotum with lateral bead translucent, disc mesad to bead narrowly rufous to piceous. Elytron piceous to black, many specimens, especially if slightly teneral, rufopiceous laterally posterad to shoulder; epipleuron black, outer margin rufopiceous. Ventral surface with proepipleuron, metacoxal processes and posterior margins of sterna 3 to 6, rufous. Legs dark rufous, most specimens with femora and metatibia somewhat darker.

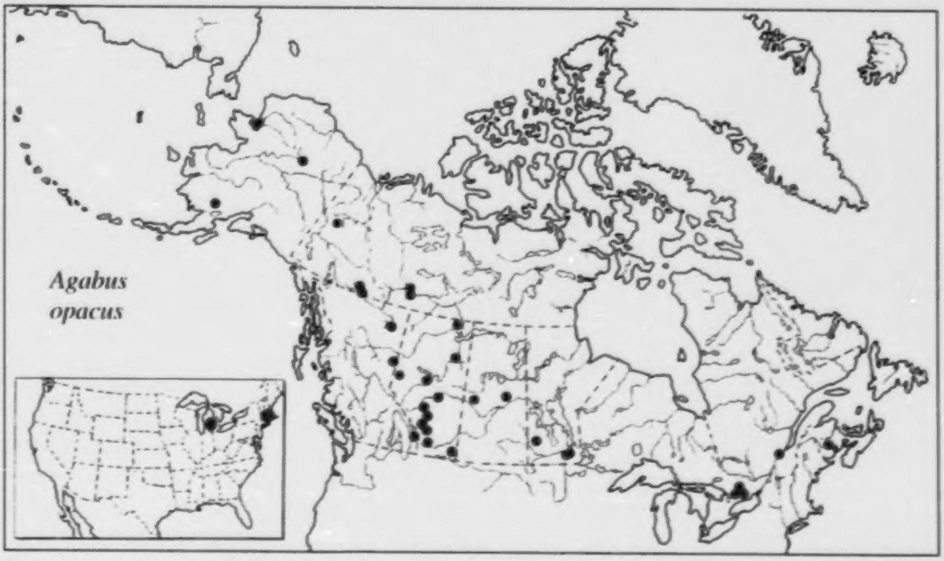
Sculpture dimorphic. Elytron of males and male-like females with clearly impressed lines forming meshes of irregular polygonal shape but of generally similar size, intersections of lines with a puncture as well as punctures present along some lines and medially on some meshes; meshes with microreticulation, somewhat effaced basomedially on some specimens. Metasternum with fine, dense transverse lines forming narrow transverse meshes. Metacoxal plate more or less regularly reticulate, with shallow transverse rugae and fine, very irregular strioles. Opaque females with lines of sculpture finer and denser; pronotum with distinct meshes of longitudinal orientation, with evident punctures and partly effaced microreticulation; elytron basally with lines fine, dense and strongly longitudinal, microreticulation coarse and obscuring lines and punctures, apex of elytron with open irregular meshes bearing granular microreticulation but punctures evident in intersections of lines; ventral surface similar to that of male.

Frons lacking frontal punctures. Pronotum (Fig. 124D) with lateral margin rounded, sides straighter and convergent in apical third; posterolateral angle broadly rounded and obtuse; lateral bead broad and well defined throughout length; disc without an evident impression near posterolateral angle; base broadly rounded with a shallow emargination each side of scutellum; proepipleuron very narrowly visible in lateral aspect. Prosternum and its process angularly convex in cross section, prosternal process short, sparsely setose laterally; apex deflected upward behind procoxae. Metasternum with anteromedial impression short and not extending posterad beyond level of middle of mesocoxae. Metasternal wings of moderate width, width metacoxa: width of metasternal wing = 2.39 to 2.96. Metafemur length: width = 2.91 to 3.44; without strioles. Metatibia with posteroventral margin with a varied number of large scattered punctures; ventral face with a longitudinal series of punctures in basal half, without micropunctation; spur shorter than metatarsomere 1, length metatibial spur: length metatarsomere 1 = 0.65 to 0.80.

Male protarsomeres 1 to 3 relatively strongly dilated, width protarsomere 1 = 0.21 to 0.23 mm, protarsal ratio = 2.02: 1.83: 1.40: 1.10: 1 (note - protarsomere 5 is strongly clavate, measurement taken at middle) and each bearing a dense pad of yellow adhesive scales beneath; protarsal claws elongate, subequal in length, posterior claw narrower and with a distinct basoventral emargination. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.44 to 0.51. Metatarsomere 1 with ventral swimming hairs. Sternum 6 with posteromedial area flattened, lateral areas with short longitudinal rugae. Paramere (Fig. 126L) with basal sclerite triangular. Aedeagus (Fig. 126J, K) in lateral aspect simple, slender, straight and evenly narrowed in apical third.

Ecology. The species is poorly represented in collections, indicating that either the habitat and species are uncommon and local over the wide range, or that the habitat is not properly known and the species therefore not well collected. Specimens typically occur in vernal pools in peaty areas, mostly along forest edges and where there are luxuriant stands of grasses such as *Calamagrostis*. Teneral specimens have been collected in April and May as well as late July and August. Nilsson (1984*b)* described the larvae and life cycle in Scandinavia.

Distribution. Map 156. The North American range of this Holarctic species extends in the boreal zone from New Brunswick and New England to Alaska, north to the tree line and south along the Rocky Mountains to northern Colorado. The species is apparently found in richer, perhaps more basic sites, for it is largely absent from the acidic, nutrient-poor waters of the Canadian Shield.



Map 156. *Agabus opacus* Aubé. Canadian and Alaskan collection localities and United States state records.

10. *Agabus discors* LeConte 1861

Fig. 127A, B

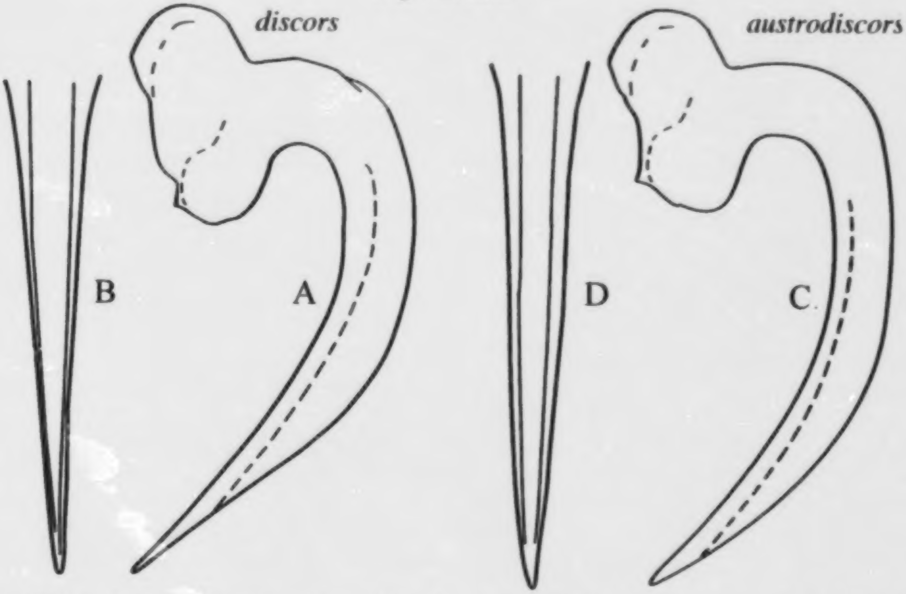


Fig. 127. *Agabus opacus*-group, aedeagus. A – B - *A. discors*, A - lateral, B - dorsal. C – D - *A. austrodiscors*, C - lateral, D - dorsal.

Agabus discors LeConte 1861: 341. Type locality - given as "Washington Territory". Type in MCZC.

Selected References. Fall 1922: 34; Hatch 1953: 227; Leech and Chandler 1956: 320; Larson 1996*b*: 634 – 635.

Description. Length = 9.2 to 11.2 mm; width = 4.7 to 5.7 mm; length: width = 1.83 to 2.00. A large, subparallel, flattened species.

Color mainly piceous to black. Head with anterior margin of clypeus and frons above base of antenna narrowly rufous, frontal spots rufous; antenna and palpi rufous, without infuscation. Pronotum with lateral bead rufous, disc adjacent to bead rufous, evenly darkening onto disc. Elytron piceous, slightly paler laterally, with a small sublateral, postmedial pale spot on some specimens; epipleuron dark rufous. Ventral surface mainly black with proepipleuron, proepisternum laterally, apex of prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous to piceous.

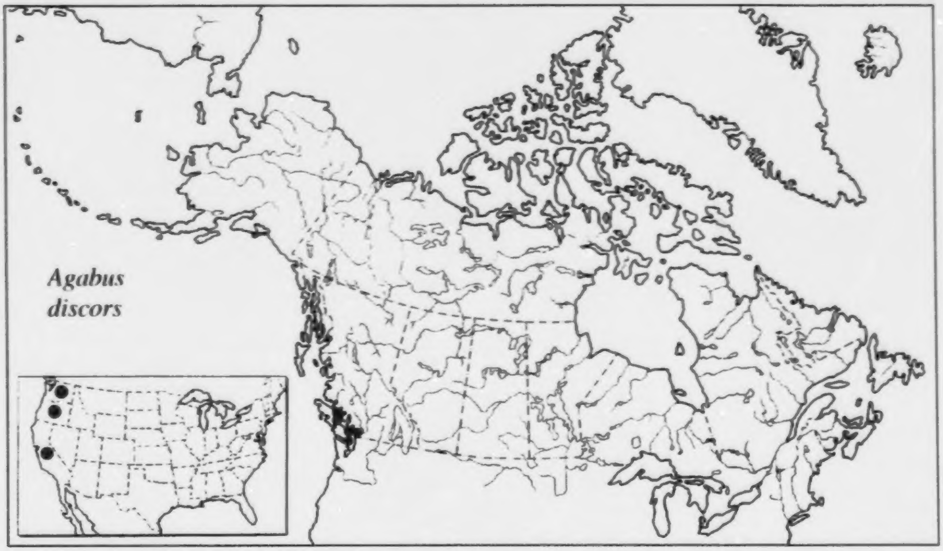
Sculpture sexually dimorphic. Male elytron with strongly longitudinally stretched meshes; meshes finely punctate and microreticulate; metacoxal plate with anastomosing longitudinal lines, not forming distinct meshes; metafemur with short, very fine strioles. Female with pattern similar that of male except lines of sculpture finer and denser, especially on elytron, and microreticulation strong giving body a silky sheen.

Frons lacking frontal punctures. Pronotum with lateral bead broad, broadest just posterad of anterolateral angle and subequal in width to or slightly narrower than apical width of a middle antennomere, gradually narrowed to posterolateral angle; bead sharply delimited along most of length; hind margin slightly bisinuate, shallowly concave mesad to each posterolateral angle and more distinctly so laterad to scutellum. Prosternum tectiform medially, midline more or less straight in lateral aspect and not elevated or swollen behind anterior margin; prosternal process tectiform, sharply angulate medially, apex pointed, sides setose, lateral bead narrow, complete to apex. Metasternum with anteromedial process very narrow between procoxae, slightly flattened, flattened area not extending much behind level of middle of mesocoxae. Metasternal wings of moderate width, width metacoxa: width of metasternal wing = 2.43 to 2.94. Metafemur moderately slender, metafemur length: width = 2.91 to 3.25. Metatibia with setae of irregular size and spacing scattered along posteroventral margin; ventral face with coarse irregular punctures on basal half and some specimens with a few on apical half, also face with numerous very small setiferous punctures. Metatibial spurs shorter than metatarsomere 1, length metatibial spur: length metatarsomere 1 = 0.68 to 0.86.

Male protarsomeres 1 to 3 broadly dilated, width of protarsomere 1 = 0.31 to 0.38 mm; protarsal ratio = 1.95: 1.93: 1.57: 1.01: 1; protarsal claws elongate, subequal in length, anterior claw distinctly widened medially, basally with ventral margin flattened and broadly emarginate, posterior claw slightly narrower, less strongly sinuate ventrally but with a more distinct basoventral emargination. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.56. Metatarsomeres 1 to 3 with ventral swimming hairs. Sternum 6 longitudinally rugose, these rugae best developed each side of middle but also less regular and sparser rugae present medially so that lateral fields are not distinctly separated. Paramere with basal sclerite large, coarsely rugose, apical sclerite elongate; aedeagus (Fig. 127A, B) in lateral aspect very narrow apically, somewhat broadened medially, basal piece large.

Ecology. Specimens have been collected from among emergent grasses and sedges in shallow pools in forest openings on Vancouver Island and several of the Gulf Islands, British Columbia.

Distribution. Map 157. This species occurs along the Pacific Coast from southwestern British Columbia to northern California.



Map 157. *Agabus discors* LeConte. Canadian and Alaskan collection localities and United States state records.

11. *Agabus austrodiscors* Larson 1996

Fig. 127C, D

Agabus austrodiscors Larson 1996*b*: 635 – 637. Type locality - Pine Lake, Lassen Co. Cal. Type in CASC.

Selected Reference. Larson 1996*b*: 635 – 637.

Description. Length = 9.0 to 10.8 mm; width = 4.6 to 5.6 mm; length: width = 1.82 to 1.99. A large species very similar to *A. discors*, reliably recognizable only on the basis of male sexual characters.

Color mainly piceous to black. Head with anterior margin of clypeus and frons above base of antenna, narrowly rufous; frontal spots rufous; antennae and palpi rufous, without apical infuscation. Pronotum with lateral bead and hind margin rufous, adjacent disc dark rufous to piceous and grading onto dark mesal disc. Elytron with a pale sublateral postmedial spot evident or not; epipleuron dark rufous. Ventral surface mainly black with proepipleuron, proepisternum laterally, apex of prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous to piceous.

Sculpture similar or differing only slightly between sexes. Male elytron with strongly longitudinally stretched meshes, meshes finely punctate and microreticulate; metacoxal plate with anastomosing longitudinal lines, not forming distinct meshes. Female with pattern similar that of male but microreticulation generally stronger, some females with microreticulation strong on elytra giving elytron a silky sheen but even these with distinct meshes over entire elytron. Metafemur with short, very fine strioles.

Frons lacking frontal punctures. Pronotum with lateral bead broad, broadest just posterad of anterolateral angle and subequal in width to or slightly narrower than apical width of a middle antennomere, gradually narrowed towards posterolateral angle and less so on anterolateral angle; bead sharply delimited along most of length; hind margin slightly bisinuate, shallowly concave mesad to each posterolateral angle and more distinctly so laterad to scutellum. Prosternum broadly longitudinally convex medially, midline more or less straight in lateral aspect and not elevated or swollen behind anterior margin; prosternal process tectiform, sharply angulate medially, apex pointed, sides setose, lateral bead narrow, complete to apex. Metasternum with anteromedial impression short and not extending much behind level of middle of mesocoxae. Metasternal wings of moderately narrow, width metacoxa: width of metasternal wing = 2.63 to 2.89. Metafemur moderately slender, metafemur length: width = 3.00 to 3.22. Metatibia with punctures of irregular size and spacing more or less continuously scattered along posteroventral margin; ventral face with medium sized punctures forming a medial series along most of length, very small setiferous punctures absent or sparse. Metatibial spurs shorter than metatarsomere 1, length of spur: length metatarsomere 1 = 0.68 to 0.82.

Male protarsomeres 1 to 3 narrower than those of *A. discors*, width of protarsomere 1 = 0.25 to 0.34 mm; protarsal ratio = 1.82: 1.76: 1.43: 1.04: 1; protarsal claws elongate, subequal in length, anterior claw distinctly widened medially, basally with ventral margin flattened and broadly emarginate, posterior claw slightly narrower, less strongly sinuate ventrally but with a more distinct basoventral emargination. Mesotarsomere 5 shorter than that of *A. discors*, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.52. Metatarsomeres 1 to 3 with ventral swimming hairs. Sternum 6 longitudinally rugose, these rugae best developed each side of middle but also less regular and sparser rugae present medially so that lateral fields are not distinctly separated; paramere with basal sclerite narrower and more elongate than that of *A. discors*, coarsely rugose, apical sclerite elongate; aedeagus (Fig. 127C, D) in lateral aspect less strongly narrowed apically than that of *A. discors*.

Ecology. Label data include "spring in Round Valley" and "Head of W Branch Indian Creek" indicating specimens have been collected from springs and small creeks. Altitude records extend from about 900 to 2200 m.

Distribution. The species occurs in northern California.

12. *Agabus confertus* LeConte 1861

Figs. 124F; 128A – C

Agabus confertus LeConte 1861: 340. Type locality - Point Reyes, California. Type in MCZC.

Selected References. Fall 1922: 32–33, Leech 1942*b*: 130, Hatch 1953: 226, Leech and Chandler 1956: 320, Larson 1996*b*: 637 – 639.

Description. Length = 7.3 to 9.0 mm; width = 4.0 to 5.0 mm; length: width = 1.76 to 1.93. Size moderate, shape relatively broadly oval.

Color piceous to black, teneral and paler specimens with a slight cupreous sheen. Head with anterior half of clypeus, frons above base of antenna and a pair of large medial frontal spots, rufous; antenna pale rufous except at least apical antennomere infuscate;

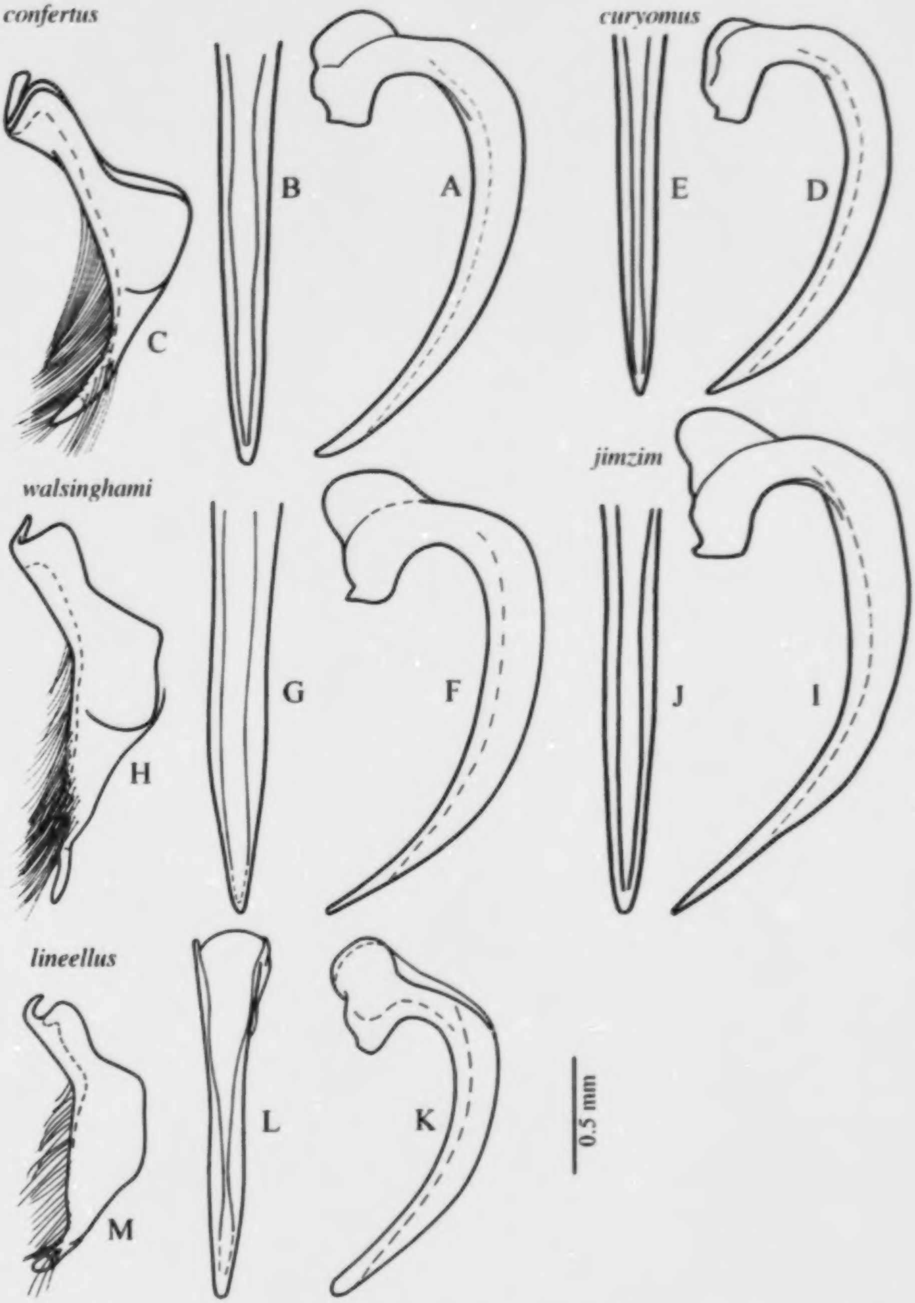

confertus
euryomus
B
A
E
D
C
jimzim
walsinghami
G
F
J
I
H
lineellus
L
K
0.5 mm
M

Fig. 128. *Agabus opacus*-group, male genitalia. A – C - *A. confertus*. A - aedeagus, lateral. B - aedeagus, dorsal. C - paramere. D – E - *A. euryomus*. D - aedeagus, lateral. E - aedeagus, dorsal. F – H - *A. walsinghami*. F - aedeagus, lateral. G - aedeagus, dorsal. H - paramere. I – J - *A. jimzim*. I - aedeagus, lateral. J - aedeagus dorsal. K – M - *A. lineellus*. K - aedeagus, lateral. L - aedeagus, dorsal. M - paramere.

palpi rufous except apical palpomere of each palpus infuscate apically. Pronotum with lateral bead translucent, rufous, anterolateral angle and lateral margin mesad to bead narrowly rufous, evenly darkened onto disc. Elytron piceous medially, lateral margin paler, rufous to rufopiceous; disc with a sublateral postmedial oval yellow spot and some specimens also with a subapical yellow spot (usually evident only on teneral specimens); epipleuron rufopiceous, paler laterally. Ventral surface mainly black except proepipleuron, proepisternum laterally, prosternal process, metacoxal processes and sterna 3 to 6 apically, rufous to rufopiceous. Legs rufous to piceous.

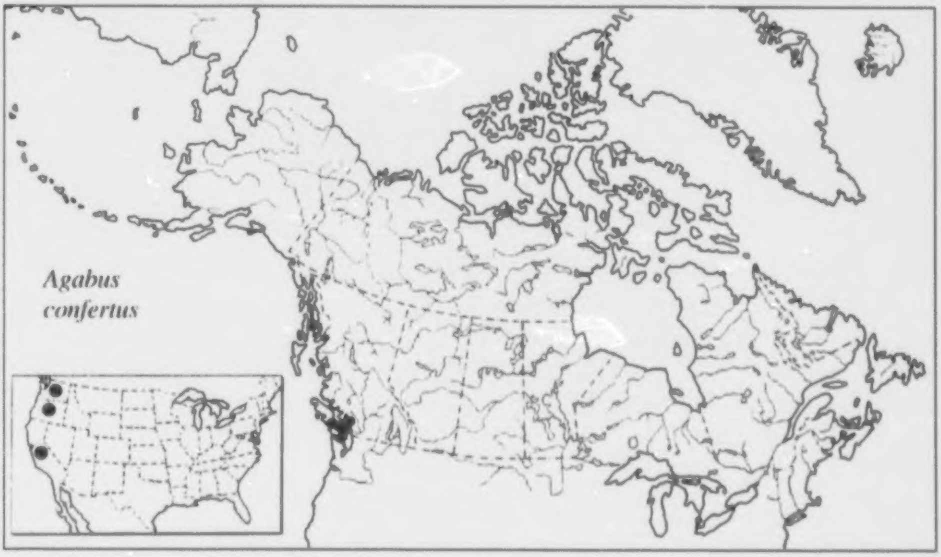
Elytron with irregular polygonal sculpture, small punctures present both in meshes and at many intersections of lines, punctures in intersections more distinct laterally and apically than basomedially on disc; meshes microreticulate but reticulation variously effaced basally and medially. Metasternum with fine transverse lines except lines obsolete mediolaterally. Metacoxal plate with irregular longitudinal lines, not forming discrete meshes, with irregular transverse rugae.

Frons lacking frontal punctures. Pronotum (Fig. 124F) with lateral bead broad, about 0.6 to 0.8 maximum width of an middle antennomere; base about as wide as elytra across humeri, posterolateral angle distinct but rounded apically and obtuse, disc flattened adjacent to angle; base broadly rounded with a distinct emargination each side of scutellum. Prosternum swollen and somewhat elevated anteromedially; midline more or less tectiform with convexity continued along midline of process to its apex; process short, its apex pointed, lateral portions setose each side of midline, narrowly margined laterally. Metasternum with anteromedial impression not extending much past level of middle of mesocoxae; metasternal wings broad, width metacoxa: width of metasternal wing = 1.90 to 2.40. Metafemur moderately narrow, metafemur length: width = 2.86 to 3.29. Metatibia with punctures of varied size irregularly scattered along posteroventral margin; medial face with punctures along entire length although punctures small and sparse distad of middle on most specimens. Metatibial spur subequal to length of metatarsomere 1, length metatibial spur: length metatarsomere 1 = 0.82 to 1.02.

Male protarsi variously but generally narrowly dilated, width protarsomere 1 = 0.16 to 0.27 mm; protarsal ratio varying geographically, British Columbia protarsal ratio = 1.73: 1.59: 1.25: 1.02: 1; California protarsal ratio = 1.57: 1.46: 1.19: 1.03: 1; protarsomeres 1 to 3 bearing dense vestiture of small oval adhesive setae beneath; protarsal claws subequal in length, anterior claw more or less straight medially, evenly arcuate to pointed apex, ventral margin slightly to rather strongly expanded medially and appearing sinuate to distinctly toothed medially; posterior claw slenderer, ventral margin emarginate basally. Mestotarsomere 5 length: combined length mesostarsomeres 1 to 4 = 0.47 to 0.57. Metatarsomeres 1 to 3 with ventral swimming hairs. Sternum 6 with longitudinal rugae each side of middle, rugose areas separated by smooth medial area which separates the rugae by a distance about equal to their length, rugae more or less oriented longitudinally and at most only slightly convergent anteriorly. Aedeagus (Fig. 128A, B) yellow, weakly sclerotized, slender, evenly arcuate in lateral aspect and shortly and evenly narrowing to bluntly rounded apex, in dorsal aspect shaft more or less parallel-sided; paramere (Fig. 128C) with basal sclerite large, triangular, apical stylus with terminal sclerite short.

Ecology. In the Gulf Islands, British Columbia, specimens were collected from small, first order streams, running through recently clear-cut areas. The streams were slow and partly impounded by logging slash. Other specimens are labelled as having been collected from "permanent ponds", "winter rain pool in woods", "small pond", and "rivulet". It is not known if this species is typically lotic or lentic.

Distribution. Map 158. The range extends along the Pacific coast from southwestern British Columbia to northern California.



Map 158. *Agabus confertus* LeConte. Canadian and Alaskan collection localities and United States state records.

13. *Agabus euryomus* Larson 1996

Figs. 124E; 128D, E

Agabus euryomus Larson 1996*b*: 639 – 641. Type locality - Sagehen Creek, Sierra Co., Cal. Type in CASC.

Selected Reference. Larson 1996*b*: 639 – 641.

Description. Length = 7.8 to 8.7 mm; width = 4.0 to 4.4 mm; length: width = 1.86 to 2.00. Similar to *A. confertus* except body relatively narrow and parallel-sided, pronotum and elytra strongly discontinuous in lateral outline.

Color mainly piceous to black. Head with anterior margin of clypeus and frons above base of antenna narrowly rufous; frons with a pair of large rufous frontal spots; antenna testaceous basally, antennomeres 3 to 11 progressively darkened and at least terminal 3 to 5 antennomeres distinctly infuscate apically; palpi pale with terminal palpomere of each palpus infuscate apically. Pronotum with lateral bead translucent, rufous, disc mesad to bead narrowly rufous to piceous and evenly grading into dark color of disc. Elytron rufopiceous, without a sublateral postmedial pale spot; epipleuron piceous mesally, lateral margin narrowly rufous. Ventral surface largely black except proepipleuron, proepisternum laterally, prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous to rufopiceous.

Elytron with lines of sculpture fine, forming polygonal meshes of approximately similar size, intersections of lines punctate, most distinctly so laterally and apically, some meshes with a puncture, meshes with strong microreticulation or some specimens (mainly males) with microreticulation effaced basomedially. Metasternum with dense transverse lines not forming coherent meshes, more or less effaced medially. Metacoxal plate with dense longitudinal lines not forming definite meshes and giving a finely corrugated surface. Metatibia without strioles.

Frons lacking frontal punctures. Pronotum (Fig. 124E) narrow, in dorsal aspect lateral margins slightly arcuate, narrower at base than elytra across shoulders so that elytral humeri project strongly behind pronotum; basal margin broadly arcuate with a distinct concavity on each side laterad of scutellum; lateral bead broad, at widest about 0.5 to 0.7 width of maximum width of a middle antennomere, bead narrowing onto anterolateral angle, inner margin of bead sharply delimited almost to front and hind angles; in lateral aspect proepipleuron visible below anterolateral angle.

Prosternum anteromedially tumid, slightly elevated from anterior margin and angularly rounded in cross-section; process angularly convex medially, process short, pointed apically, sides setose each side of midline, lateral bead narrow, complete to apex. Metasternum with anteromedial impression short and extending only slightly behind level of middle of mesocoxae; metasternal wings broad, width metacoxa: width of metasternal wing = 1.79 to 2.11. Metafemur slender, metafemur length: width = 3.11 to 3.58. Metatibia with a row of well separated punctures along posteroventral margin, ventral face with punctures mainly restricted to basal half; metatibial spur long, length metatibial spur: length metatarsomere 1 = 0.88 to 1.00.

Male protarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.18 to 0.20 mm; Protarsal ratio = 1.60: 1.50: 1.30: 1.03: 1; protarsal claws slender, subequal in length, anterior slightly broader and distinctly broadened ventrally near middle, posterior claw with a basoventral emargination. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.57. Metatarsomeres 1 to 4 with ventral swimming hairs. Sternum 6 flat and smooth medially, flat area from hind margin anteriorly first finely punctate, with separated large setiferous punctures and medially with transverse strioles and rugae; sternum laterally with longitudinal rugae, rugose areas apically separated by a distance about equal to their length, inner and medial rugae slightly convergent anteriorly. Aedeagus (Fig. 128D, E) yellow, slender, not broadened medially in dorsal aspect, in lateral aspect apex narrowed in apical third; paramere with basal sclerite large, triangular, apical lobe long.

Ecology. These beetles occur amongst emergent vegetation of pools and quiet sections of small, low-gradient streams.

Distribution. This is an inland species, occurring along the Sierra Nevada Mountains of California north into eastern Oregon and Idaho.

14. *Agabus walsinghami* (Crotch 1873)

Figs. 124G; 128F – H

Gaurodytes walsinghami Crotch 1873: 419. Type locality - Oregon. Type in MCZC.

Selected References. Sharp 1882*a*: 519, Hatch 1953: 226, Leech and Chandler 1956: 320, Larson 1996*b*: 641 – 643.

Description. Length = 7.0 to 8.9 mm; width = 3.8 to 5.0 mm; length: width = 1.81 to 2.00. Similar to *A. confertus* in size but shape generally narrower.

Color mainly rufopiceous to black, many specimens with a faint bronze sheen. Head with anterior half of clypeus, frons above base of antenna and a pair of large frontal spots, rufous; palpi rufous basally, apical half of terminal palpomere of each palpus infuscate; antenna rufous except at least apical antennomere infuscate medially, many specimens with several apical antennomeres infuscate. Pronotum with lateral bead translucent, rufous, anterolateral angle and lateral margin adjacent to bead rufous, rufous area gradually grading to piceous medially on disc. Elytron rufopiceous, paler laterally, with an oval postmedial, sublateral yellow spot; epipleuron rufous. Ventral surface mainly black except proepipleuron, proepisternum, metacoxal processes and hind margin of abdominal sterna 3 to 6, rufous. Legs rufous to rufopiceous, metatibia and tarsi darker.

Male elytron medially with lines fine, forming irregularly shaped meshes of similar size, intersections of lines with small, sometimes inconspicuous punctures, meshes with variously effaced microreticulation; laterally and apically punctures in intersections of lines distinct, microreticulation distinct on most meshes. Female similar to male or some specimens with elytron basally with meshes slightly to distinctly longitudinally stretched; elytron with meshes strongly microreticulate over most of disc or on some specimens variously effaced basomedially. Metasternum with short transverse strioles, fine lines largely effaced except for a small sublateral patch on each side. Metacoxal plate with longitudinal, anastomosing lines generally not forming distinct meshes and with transverse rugae.

Frons lacking frontal punctures. Pronotum (Fig. 124G) with lateral bead relatively broad, at maximum width about 0.5 to 0.8 maximum width of a middle antennomere, bead distinctly limited medially but on most specimens becoming low and more or less continuous with disc distinctly anterior to posterolateral angle; pronotum at base more or less as wide as elytra across shoulders; posterolateral angle distinct, narrowly rounded apically but more or less right angled; basal margin slightly and broadly convex except for a slight emargination each side of middle. Prosternum and prosternal process tectiform in cross-section with a distinct medial longitudinal convexity; prosternum in lateral aspect with midline concave anterior to process; process short, pointed apically, setose laterally with narrow lateral margin; metasternum with anteromedial impression short and extending only shortly past level of middle of mesocoxae. Metasternal wings broad, width metacoxa: width of metasternal wing = 1.89 to 2.38. Metatibia slender, metafemur length: width = 3.03 to 3.44. Metatibia slender, with a series of large, isolated punctures along posteroventral margin, ventral face with medial punctures extending along entire length of most specimens, best developed on females. Metatibial spur long, subequal to or slightly shorter than metatarsomere 1, length metatibial spur: length metatarsomere 1 = 0.87 to 1.00.

Male protarsomeres narrow, width protarsomere 1 = 0.16 to 0.20 mm; protarsal ratio = 1.62: 1.51: 1.29: 1.10: 1; protarsomeres 1 to 3 each bearing dense cluster of oval adhesive scales beneath; protarsal claws slender, subequal, anterior claw with a slight to distinct basoventral tooth, posterior claw distinctly emarginate basally, medially straight and narrow then arcuate and evenly narrowed to apex. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.51 to 0.61. Metatarsomeres 1 to 3 with ventral swimming hairs. Sternum 6 with a field of longitudinal rugae each side of middle, these rugae converging anteriorly and area between anterior portions of fields punctate and transversely rugose so that rugae can be traced in irregular concentric arcs around flattened posteromedial portion of sternum. Aedeagus (Fig. 128F, G) in lateral aspect with dorsal margin more or less straight and converging in apical third to sharply pointed apex, in dorsal aspect apex acutely pointed, sides slightly diverging to middle then slightly constricted anterior of middle; paramere (Fig. 128H) with basal sclerite ovate, apical sclerite elongate.

Ecology. The species occurs in small, headwater streams and spring-fed pools.

Distribution. The range extends from southern Washington to northern Mexico.

15. *Agabus jimzim* Larson 1996

Figs. 124H; 128I, J

Agabus jimzim Larson 1996*b*: 643 – 644. Type locality - Williams Arizona. Type in USNM.

Selected Reference. Larson 1996*b*: 643 – 644.

Description. Length = 7.3 to 8.4 mm; width = 4.0 to 4.6 mm; length: width 1.77 to 1.89. Very similar to Sierra Nevada specimens of *A. walsinghami*, differing only in shape of the male aedeagus.

Color mainly dark rufous to piceous. Head with anterior part of clypeus, frons above base of antenna and frontal spots, rufous; antenna rufous with at least apical antennomere infuscate medially; palpi rufous except apical palpomere of each palpus infuscate. Pronotum with lateral bead rufous, disc mesad to bead rufous and gradually darkening medially onto disc; basal and anterior margins rufous to piceous. Elytron piceous medially, becoming paler, rufopiceous laterally, with an elongate sublateral, postmedial yellow spot; epipleuron piceous medially, paler laterally. Ventral surface mainly dark with proepipleuron, proepisternum laterally, prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous to piceous.

Elytron basomedially with irregular polygonal meshes, meshes with small punctures, lines and intersections generally without distinct punctures; laterally lines finer and distinct punctures present at many intersections; meshes smooth medially, laterally and apically with distinct microreticulation. Metasternum medially with short separated transverse lines, microlines obsolete except for an oval patch each side of middle. Metacoxal plate with longitudinal anastomosing lines, not forming discrete meshes, interspaces with small punctures and rudiments of microreticulation. Metafemur without strioles.

Frons lacking frontal punctures. Pronotum (Fig. 124H) with lateral bead broad medially, maximum width 0.7 to 0.9 maximum width of a medial antennomere, bead well defined medially, narrowing and becoming obsolete on anterolateral angles and indistinctly limited from basolateral impressions towards posterolateral angle; basal margin bisinuate, slightly concave mesad to posterolateral angle and more strongly so lateral to scutellum. Prosternum tumid and rounded anteromedially, posteriorly midline angulate and continuous with that of prosternal process; process short, pointed apically, setose laterally, lateral bead narrow and continuous to apex. Metasternum with anteromedial impression not extending posteriorly much past level of middle of mesocoxae; metasternal wings broad, width metacoxa: width of metasternal wing = 1.94 to 2.21. Metafemur narrow, metafemur length: width = 3.10 to 3.29. Metatibia with large separated punctures along length of posteroventral margin, ventral face with punctures along entire length, lacking micropunctures; metatibial spur long, length metatibial spur: length metatarsomere 1 = 0.89 to 1.05.

Male protarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.16 to 0.19 mm; protarsal ratio = 1.58: 1.50: 1.15: 1.08: 1; protarsal claws slender, anterior straight medially with a ventral expansion or tooth, apex evenly arcuate and narrowed, posterior claw similar but slenderer, not widened medially and with a basal emargination. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.54. Metatarsomeres 1 to 3 with ventral swimming hairs. Sternum 6 slightly flattened medially, flattened area finely punctate apically, medially with fine irregular transverse rugae; laterally with numerous strong longitudinal rugae, rugae convergent anteriorly and innermost ones more or less continuous with transverse rugae to form a concentric pattern around posteromedial part of sternum. Aedeagus (Fig. 128I, J) similar to that of *A. walsinghami* but narrower in dorsal aspect, not distinctly widened subapically.

Ecology. The habitat has not been described. Altitude records range from about 1300 to 2500 m. A specimen collected 23 May is very teneral and other specimens collected May and June are slightly teneral.

Distribution. This species is known only from Arizona.

16. *Agabus lineellus* LeConte 1861

Fig. 128K – M

Agabus lineellus LeConte 1861: 340. Type locality - California. Type in MCZC.

Selected References. Fall 1922: 19; Leech and Chandler 1956: 319; Larson 1989: 867, 871; Fery and Nilsson 1993: 80 – 81, Larson 1996*b*: 644 – 646.

Description. Length = 6.9 to 7.8 mm; width = 3.7 to 4.3 mm; length: width = 1.75 to 1.90. A moderate sized, oval species with distinctive longitudinally striped elytra.

Head pale rufous to reddish brown with diffuse darker markings medially on frons, on some specimens these distinctly delimiting a pair of frontal spots; antenna pale rufous, apical antennomere infuscate apically; palpi rufous, apical palpomere of each palpus infuscate. Pronotum rufous medially, becoming paler laterally, many specimens with transverse infuscate areas submarginally to anterior and posterior margins. Elytron mainly yellow, sutural margin and apex narrowly piceous, disc with four longitudinal medial vittae and one or two variously developed sublateral vittae; discal vittae separated from base by a yellow area and stopping well short of apex, vittae may be slender, well separated and broken in apical third to broadened and variously fused; sublateral markings may be reduced to a vague subapical spot or form distinct vittae which extend from basal half almost to apex; epipleuron yellow. Ventral surface of thorax mainly piceous to black except proepipleuron, proepisternum, prosternal process and metacoxal processes, rufous; abdomen rufous to rufopiceous with sternum 1 basally and sterna 3 to 6 apically, paler. Legs brownish-yellow to pale rufous.

Elytron with lines of sculpture fine, forming meshes of irregular polygonal shape, meshes basomedially with a tendency towards longitudinal stretching; some intersections with a small puncture, most meshes with one or two fine punctures and some with variously developed microreticulation, especially apically. Metacoxal plate with fine, generally separated longitudinal lines not forming coherent meshes, interspaces sparsely punctate, with variously effaced longitudinally stretched microreticulation.

Frons lacking frontal punctures. Pronotum with lateral bead about 0.5 width of maximum width of a middle antennomere, bead shallowly delimited from disc, especially on anterolateral angle where it is more or less obsolete; base rounded with a distinct but broad and shallow emargination on each side lateral to scutellum; in lateral aspect disc curved down laterally and proepipleuron only narrowly visible below anterolateral angle. Prosternum medially protuberant at anterior margin, medially convexly angulate; process tectiform, setose, apex pointed but short, lateral bead narrow, continuous to apex. Metasternum with anteromedial impression short; metasternal wings of moderate width, width metacoxa: width of metasternal wing = 2.03 to 2.33. Metafemur very finely punctate, without strioles; slender, metafemur length: width = 2.94 to 3.27. Metatibia with from 0 to 7 punctures scattered irregularly along posteroventral margin, most specimens with one or more punctures on distal half; mesal surface with an irregular series of small punctures on at least basal half, most specimens with series continuing although more sparsely onto distal half, surface otherwise smooth and without micropunctures; metatibial spur long, subequal to length of metatarsomere 1, length metatibial spur: length metatarsomere 1= 0.95 to 1.10.

Male protarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.14 to 0.17 mm; protarsal ratio = 1.53: 1.43: 1.21: 1.05: 1; protarsal claws slender, subequal in length, anterior claw with a broad ventrobasal emargination, posterior claw slender with ventral margin straight medially. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.52. Metatarsomeres 1 to 3 with ventral swimming hairs. Sternum 6 generally with isolated punctures and strioles except each side of middle surface punctate-rugose with a few weakly developed longitudinal rugae. Paramere (Fig. 128M) with basal sclerite elongate-triangular; aedeagus (Fig. 128K, L) straight in dorsal aspect, in lateral aspect evenly arcuate, apex bluntly rounded.

Ecology. No habitat data are available. Water beetles with well developed color patterns are usually found in exposed habitats, such as over bare clay of temporary ponds or sand or gravel margins of ponds and streams (Young 1960c). Possibly the species occurs in temporary (and perhaps saline?) ponds in the vicinity of San Francisco Bay and in the Central Valley of California. Teneral specimens have been collected from March 27 to April 28.

Distribution. This species has a very restricted range, being known only from the vicinity of San Francisco Bay and from the Central Valley of California.

Agabus semivittatus-group
Figs. 129 – 131

Diagnosis. Medium sized, length = 6.6 to 9.6 mm, broadly oval with lateral outline continuous, somewhat depressed to convex; color mainly black but elytron with a yellow submarginal vitta on apical half. Clypeus with anterior bead incomplete; frons lacking frontal punctures; pronotum with anterior bead complete, anterior submarginal row of punctures largely contiguous except narrowly broken medially; prosternal process with lateral bead broadly dilated behind procoxa; metatibia with longer spur subequal in length to metatarsomere 1; male anterior protarsal claw (Fig. 130) with a basal or subbasal tooth.

Comments. This Nearctic group has been revised by Larson and Wolfe (1998). The six species occur in eastern and southern North America.

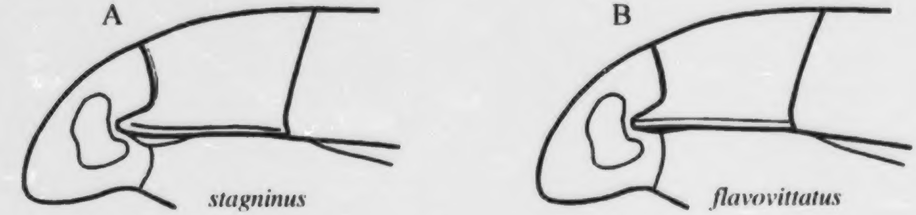

A
B
stagninus
flavovittatus

Fig. 129. *Agabus semivittatus*-group, pronotum lateral aspect. A - *A. stagninus*. B - *A. flavovittatus*.

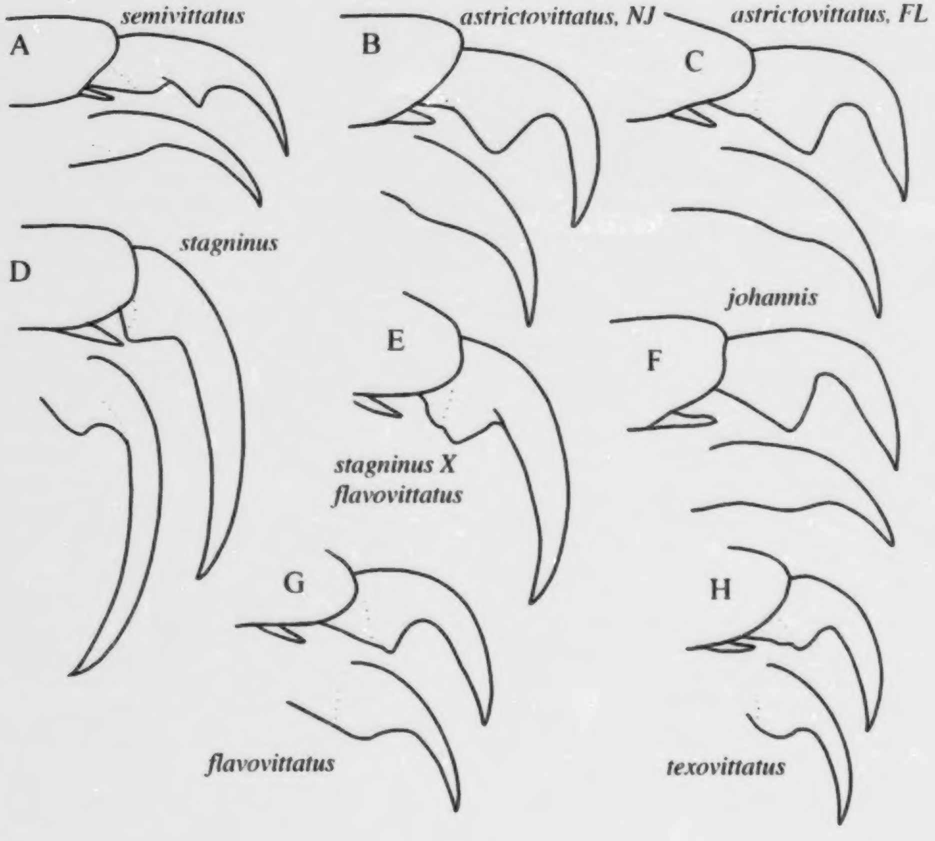

semivittatus
A
astrictovittatus, NJ
B
astrictovittatus, FL
C
stagninus
D
E
stagninus X flavovittatus
johannis
F
G
flavovittatus
H
texovittatus

Fig. 130. *Agabus semivittatus*-group, male protarsal claws, anterior. A - *A. semivittatus*. B - *A - astrictovittatus*, New Jersey. C - *A. astrictovittatus*, Florida. D - *A. stagninus*. E - *A. stagninus* X *A. flavovittatus*. F - *A. johannis*. G - *A. flavovittatus*. H - *A. texovittatus*.

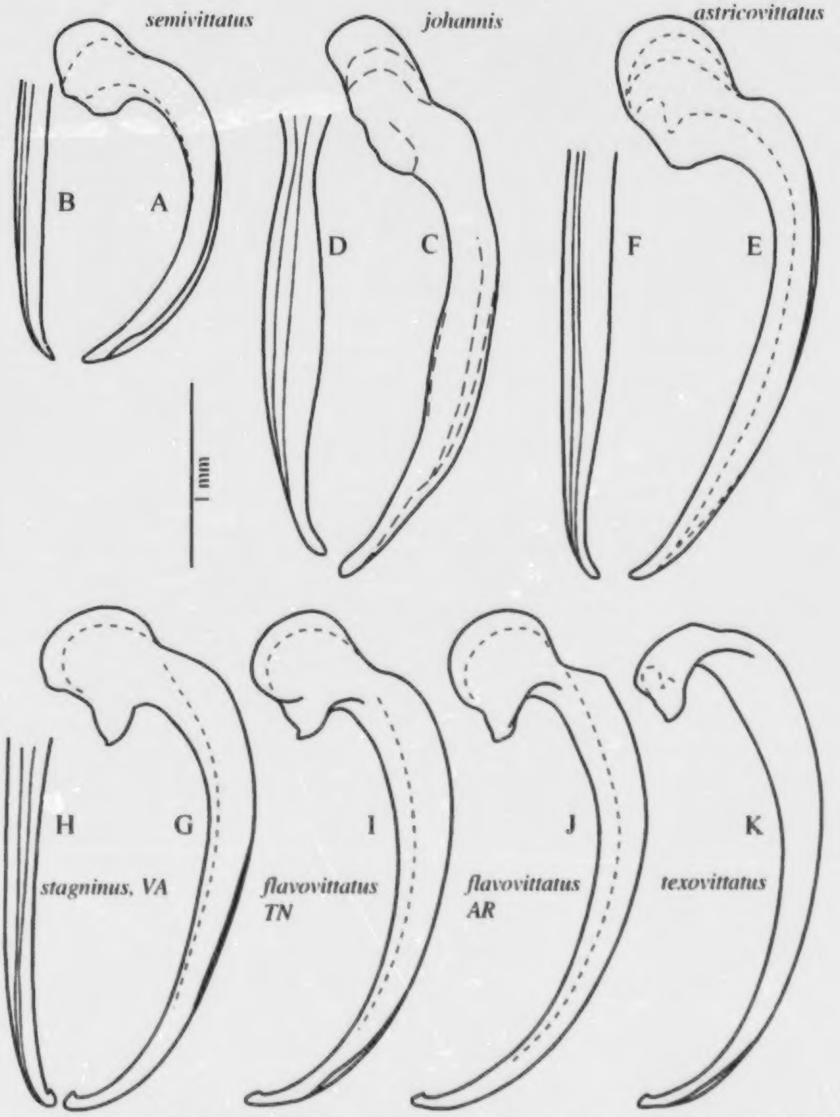

semivittatus
johannis
astricovittatus
B
A
D
C
F
E
1 mm
H
G
I
J
K
stagninus, VA
flavovittatus
TN
flavovittatus
AR
texovittatus

Fig. 131. *Agabus semivittatus*-group, aedeagus. A – B - *A. semivittatus*, A - lateral, B - apex dorsal. C – D - *A. johannis*, C - lateral, D - apex dorsal. E – F - *A. astrictovittatus*, E - lateral, F - apex dorsal. G – H - *A. stagninus*, Virginia, G - lateral, H - apex dorsal. I – J - *A. flavovittatus*, I - lateral, Tennessee, J - lateral, Arkansas. K - *A. texovittatus*, lateral.

17. *Agabus semivittatus* LeConte 1852

Figs. 130A; 131A, B

Agabus semivittatus LeConte 1852: 204. Type locality given as Colorado.

Selected References. Fall 1922: 10 – 11; Anderson 1962: 68; Michael and Matta 1977: 29; Hilsenhoff 1993*c*: 189; Larson and Wolfe 1998: 37 – 38.

Description. Length = 6.6 to 8.7 mm; width = 3.6 to 4.8 mm; length: width = 1.75 to 1.87; length: depth = 2.94 to 3.50. Smallest species of group but size highly varied, body relatively flattened.

Head piceous to black with frontal spots, clypeus and anterolateral portions of frons rufous. Antenna and palpi yellow, without infuscation. Pronotum black medially, lateral bead and lateral margins rufous. Elytra piceous to black, with a yellow sublateral vitta extending from near middle to near apex, vitta may be more or less linear or on most specimens broadened at its apex, some specimens with vitta narrowed or completely broken medially to produce separate anterior and posterior spots; epipleuron dark rufous to piceous. Ventral surface and legs dark rufous to piceous.

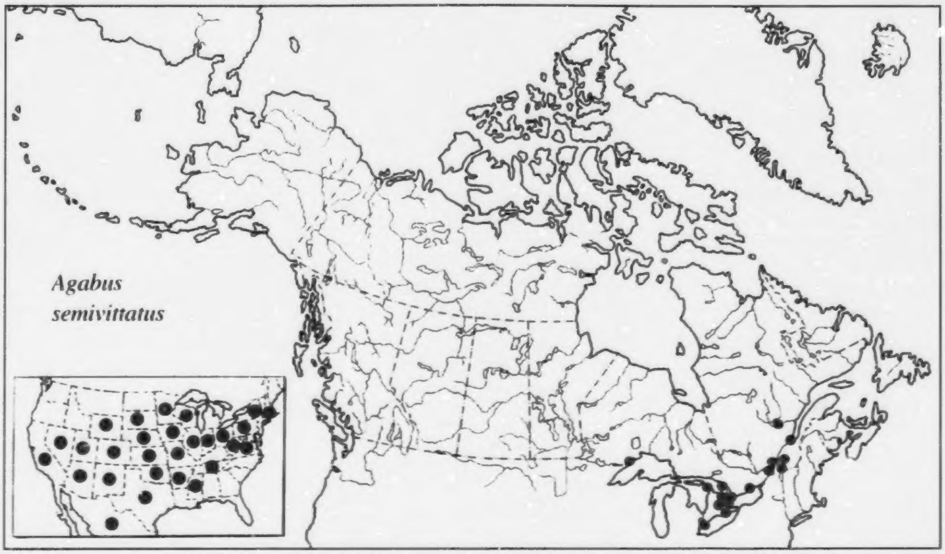
Sculpture similar on both sexes. Elytron with fine lines forming irregular, flat meshes, meshes with a distinct tendency to be arranged in transverse series especially towards apex; very fine, inconspicuous punctures at intersections of lines. Metasternum medially polished with short transverse strioles and minute punctures. Metacoxal plate with coarse longitudinal lines forming irregular longitudinal meshes, meshes with faint rugosity or microreticulation. Sternum 6 smooth with transverse lines or open irregular transverse meshes, finely and sparsely punctate.

Pronotum with lateral bead about two-thirds maximum width of antennomeres 5 to 7, narrowed anteriorly on anterolateral angle of some specimens; posterolateral angle slightly produced, basal margin slightly bisinuate, concave near posterolateral angle and convex medially; lateral margin in lateral aspect more or less straight, proepipleuron obscured or only very narrowly visible at anterior angle. Prosternum longitudinally convex but rounded medially, prosternal process broad, with a low even medial convexity, lateral bead strongly inflated basally on process, very narrow on apical half. Width metacoxa: width of metasternal wing = 3. 17 to 4.05. Metafemur length: width = 2.46 to 2.81. Metatibia length: width = 3.26 to 4.19. Length metatibial spur: length metatarsomere 1 = 0.91 to 1.14.

Male protarsomeres 1 to 3 very slightly broadened, protarsomere 1 width = 0.12 to 0.14 mm; protarsal ratio = 1.60: 1.48: 1.34; 1.16: 1; ventrally protarsomere 1 at its apex and protarsomeres 2 and 3 with short, small adhesive setae. Protarsal claws (Fig. 130A) short, anterior claw slightly longer, broader and more arcuate than posterior and with a small right-angled to acute ventrobasal tooth; posterior claw without such a tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.40 to 0.48. Paramere with basal sclerite elongate-oval, rugae obsolete; aedeagus (Fig. 131A, B) short, length = 1.29 to 1.40 mm, evenly arcuate in lateral aspect, apex laterally flattened and curved to right, without an acute hook.

Ecology. The species generally occurs in lotic habitats such as streams, seeps and spring-fed ponds although some specimens have been collected from grassy margins of lentic habitats. The larva was described by Barman (1972) who collected them from a stream where they occurred in pools and backwater areas that were devoid of higher plants. Apparently the adult stage is the principal overwintering stage (Hilsenhoff 1993*c*).

Distribution. Map 159. This is the most widely distributed species of the group. The range extends in an oblique belt across the continent from Quebec and New York to southeastern California and north-central Mexico.



Map 159. *Agabus semivittatus* LeConte. Canadian and Alaskan collection localities and United States state records.

18. *Agabus johannis* Fall 1922

Figs. 130F; 131C, D

Agabus johannis Fall 1922: 10-11. Type locality – St. John's Bluff, E. Florida.

Selected References. Young 1954: 100 – 101; Epler 1996: 3.21; Larson and Wolfe 1998: 38 – 40.

Description. Length = 8.5 to 9.5 mm; width = 4.7 to 5.2 mm; length: width = 1.71 to 1.85; length: depth = 2.77 to 3.21. Relatively large and rather strongly convex dorsally.

Body mainly piceous to black. Head basally and medially, with frontal spots, clypeus and anterolateral margins of frons paler and rufous; antenna and palpi reddish-yellow, antennomere 11 of many specimens infuscate medially. Pronotum with lateral bead and margin narrowly adjacent to bead rufous; posterior margin narrowly rufous. Elytron with a longitudinal sublateral yellow stripe beginning near or slightly anterior to middle and ending near apex; epipleuron piceous, rufous medially. Ventral surface rufopiceous to piceous, sterna 3 to 5 with hind margin conspicuously paler rufous. Legs rufous to rufopiceous.

Sculpture sexually varying. Male elytron with meshes small and rounded over most of disc but basomedially fusion of meshes producing some larger more irregular meshes; surface with more or less even, fine punctation. Female elytron with lines deeper than on male, of irregular polygonal shape and varied size, lacking evident punctation but at least extreme apex of elytron with fine, regular isodiametric sculpture and evident punctation. Metasternum medially with fine transverse lines but without distinct meshes. Metacoxal plate with dual sculpture, with coarser irregular slightly longitudinal meshes which in turn bear finer more regular microreticulation. Metafemur with longitudinal lines and very fine punctures, without distinct strioles. Sternum 6 with small, mainly transverse meshes; with sparse micropunctures and distinct larger apicolateral punctures.

Antennae slender, relatively short, reaching about level of posterolateral angles of pronotum. Pronotum with posterolateral angle right angled to slightly produced and acute; basal margin more or less evenly rounded except slightly produced medially; lateral bead at widest narrower than to about subequal in width to maximum width of antennomere 7, bead slightly and evenly narrowed to front angle; lateral margin in lateral aspect more or less straight, proepipleuron barely visible on anterior angle. Prosternum medially with broadly angulate longitudinal convexity; process flatter, broadly and evenly convex in cross-section; lateral bead very broad at base, narrow medially and disappearing near apex; process elongate, received into sharply delimited broad impression of anteromedial lobe of metasternum, impression extending posteriorly almost to level of hind margin of mesocoxae. Metasternal wings narrow, width metacoxa: width of metasternal wing = 3.38 to 3.92. Metafemur broad, metafemur length: width = 2.35 to 2.55, more or less evenly widening apically and posteroapical angle only slightly produced and acute. Metatibia length: width = 3.33 to 4.00; metatibia with small punctures along hind margin in basal half only, ventral face largely impunctate except a few small punctures at base. Metatibial spurs long, length longer spur: length metatarsomere 1 = 0.96 to 1.13. Male swimming hairs present along outer margin of metatarsomeres 1 to 4; tarsomeres dorsally with posteroapical angle slightly lobed. Metatarsal claws slightly unequal, dorsal claw slightly narrower and less arcuate than ventral claw.

Male protarsomeres 1 to 3 slightly dilated, width protarsomere 1 = 0.16 to 0.18 mm; protarsal ratio = 1.83: 1.66: 1.36: 1.15: 1; ventrally with small elongate, adhesive setae, setae smallest basally on tarsomere 1, larger apically on tarsomere 1 and on 2 and 3. Protarsal claws (Fig. 130F) short, subequal in length, anterior slightly thicker in dorsal aspect; anterior claw in anterior aspect strongly arcuate, with a large slightly acute basal tooth ventrally; posterior claw less strongly arcuate, broad basally but without a ventral tooth. Mesotarsus with tarsomere 5 relatively short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.38 to 0.43. Sternum 6 not modified. Aedeagus (Fig. 131C, D) elongate, length = 2.3 to 2.32 mm, strongly sclerotized, medially with ventral margin obliquely flattened, in lateral aspect ventral margin slightly sinuate towards apex; dorsal groove extending almost to apex and disappearing on mediodorsal side; apex without an acute ventral hook. Paramere with a large, almost round basal sclerite with concentric rugae, apical stylus slender and elongate, with a slender apical sclerotized tip.

Ecology. This species occurs in vegetation and debris in springs and along the margins of small streams (Young 1954).

Distribution. Known only from Florida with collection records from along the southern portions of the coastal panhandle and from peninsular Florida.

19. *Agabus astrictovittatus* Larson and Wolfe 1998

Figs. 130C; 131E, F

Agabus astrictovittatus Larson and Wolfe 1998: 40 – 42. Type locality - Ft. Walton Beach, Okaloosa Co., Florida. Type in CNC.

Selected Reference. Larson and Wolfe 1998: 40 – 42.

Description. Length = 7.6 to 8.8 mm; width = 4.1 to 4.8 mm; length: width = 1.75 to 1.87; length: depth = 2.76 to 3.14. Very similar to *A. johannis*, recognizable with certainty only on basis of male genitalia. Smaller and slightly narrower on average but similarly convex:

Color mainly piceous to black. Head with frontal spots, clypeus and anterolateral angles of frons rufous. Pronotum with lateral bead and margin reddish. Elytron with a sublateral yellow vitta beginning near middle of elytral length and extending almost to apex, vitta narrowed or broken medially on many specimens producing isolated medial and subapical spots. Ventral surface and legs rufous to piceous.

Sculpture differing between sexes. Male elytron basomedially with meshes of irregular shape and size, apically with some transverse stretching, extreme apex with meshes small, rounded and more granular; laterally with intermixed small, rounded meshes and larger irregular meshes, punctures obscure basally and medially, small but evident laterally and apically. Female sculpture with lines deeper, meshes more granular, elytron with meshes of irregular size and shape over most of surface except at apex lines shallow, meshes small and many with transverse stretching or arranged in irregular transverse series, more irregular than that of *A. johannis;* micropunctation fine, obscure except at extreme apex.

Width of metasternal wing narrow, width metacoxa: width of metasternal wing = 3.32 to 4.22. Hind legs slightly slenderer, metafemur length: width = 2.42 to 2.68; metatibia length: width = 3.46 to 4.27.

Male protarsomeres relatively slender, width protarsomere 1 = 0.15 to 0.19 mm. Anterior protarsal claw (Fig. 130C) with a large, quadrate basal tooth. Aedeagus (Fig. 131E, F) elongate, length = 2.23 to 2.37 mm, slender, without oblique flattening on medioventral surface; apex without an acute ventral hook.

Ecology. The usual habitat is probably amongst grasses and plant debris at the margin of small, forest streams although specimens have also been collected from temporary and woodland ponds.

Distribution. This species occurs along the Atlantic coast from New York to northern Florida and along the Gulf Coast of Florida and Alabama.

20. *Agabus stagninus* (Say 1823)

Figs. 129A; 130D, E; 131G, H

Colymbetes stagninus Say 1823: 100. Type locality not given. Type lost.

Selected References. Sharp 1882*a*: 504; Fall 1922: 11–12; Michael and Matta 1977: 30; Larson and Wolfe 1998: 42 – 44.

Description. Length = 8.5 to 9.6 mm; width = 4.7 to 5.3 mm; length: width = 1.75 to 1.85; length: depth = 3.00 to 3.62. A large, broad, somewhat flattened species.

Head piceous to black medially with frontal spots, clypeus and anterolateral portions of frons, rufous. Antennae and palpi reddish yellow, without infuscation. Pronotum black medially, lateral bead and margins narrowly rufous. Elytron piceous to black, with a narrow sublateral vitta starting slightly anterior of middle and continuing almost to apex; epipleuron rufous to piceous. Ventral surface and legs rufous to piceous.

Sculpture varying individually and between sexes. Male elytron with lines lightly impressed, forming small, irregular polygonal meshes, small punctures present at many intersections, most distinctly so apically and laterally where meshes are smaller and more regular. Some females similar to male but with lines deeper, meshes of varied size but stronger than on male, some specimens with meshes very small and more or less granular; elytron of many specimens with meshes bearing traces of microreticulation especially basally and some specimens with many meshes basally and medially longitudinally stretched. Metasternum medially shiny, with a few transverse lines and sparse very fine punctures. Metacoxal plate with meshes irregular anteromedially, longitudinally stretched laterally and posteriorly, larger meshes rugose or with fine microreticulation. Sternum 6 with more or less separated transverse lines, interspaces shiny or basally and laterally with faint transverse microreticulation, fine punctures present both in strioles and on interspaces.

Pronotum (Fig. 129A) with lateral bead relatively wide, at widest about equal in width to maximum width of antennomeres 5 to 7, on most specimens evidently narrowed on anterolateral angle in dorsal aspect; in lateral aspect lateral margin slightly but distinctly curved upwards on anterolateral angle. Posterolateral angle distinctly produced; posterior margin more or less evenly rounded medially. Metasternal wings relatively broad, width metacoxa: width of metasternal wing = 2.77 to 3.31. Metafemur length: width = 2.46 to 2.83. Metatibia length: width = 3.50 to 4.42. Length metatibial spur: length metatarsomere 1 = 0.93 to 1.07.

Male protarsomeres 1 to 3 relatively broadly dilated, width protarsomere 1 = 0.23 to 0.27 mm; protarsal ratio = 2.15: 1.80: 1.33: 1.10: 1, ventrally protarsomere 1 with small adhesive setae, apically and protarsomeres 2 and 3 with larger oval adhesive setae; protarsal claws (Fig. 130D, E) elongate, anterior claw very slightly shorter than posterior and narrower in dorsal aspect, in anterior aspect evenly arcuate with a small basal tooth, posterior similar in shape but narrower. Mesotarsus elongate, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.48, mesotarsal claws large. Aedeagus (Fig. 131G, H) elongate, length = 2.27 to 2.41 mm, apex recurved and with a small projection. Parameres with basal sclerite ovoid, rugae fine and more or less obsolete apically and laterally.

Ecology. Michael and Matta (1977) state "the preferred habitat of *Agabus stagninus* is open marsh ponds of the coastal plain".

Distribution. This species has a rather narrow range, occurring along the Atlantic seaboard from Long Island to Florida and along the Gulf Coast from Florida to Alabama.

21. *Agabus flavovittatus* Larson and Wolfe 1998

Figs. 129B; 130E, G; 131I, J

Agabus flavovittatus Larson and Wolfe 1998:44. Type locality - Tennessee, Hamblen - Cocke Co. line. Type in USNM.

Selected Reference. Larson and Wolfe 1998: 44 – 46.

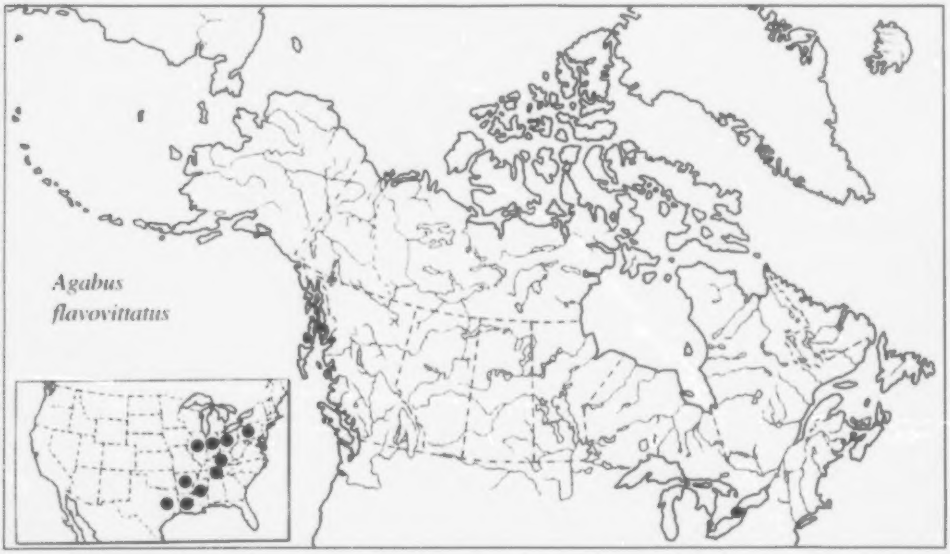
Description. Length = 7.8 to 9.1 mm; width = 4.4 to 5.0 mm; length: width = 1.75 to 1.87; length: depth = 3.11 to 3.49. Very similar to *A. stagninus*, differing mainly in male characters; on average slightly smaller and broader in outline.

Differing from *A. stagninus* as follows. Sternum 6 with lines of sculpture longer and less deeply impressed, punctation less distinct. Pronotum (Fig. 129B) in lateral aspect with lateral margin straight and not curved upwards anteriorly.

Male protarsi moderately broadly dilated width protarsomere 1 = 0.17 to 0.29 mm; protarsal ratio = 2.47: 2.01: 1.45: 1.13: 1; protarsal claws (Fig. 130E, G) shorter than those of *A. stagninus*, subequal in length, anterior claw in anterior aspect strongly curved near middle, apex more or less straight, with a large basoventral tooth; posterior claw slender apically with a blunt basoventral tooth. Aedeagus (Fig. 131I, J) shorter, length = 2.02 to 2.10 mm, more evenly tapered over length and more evenly arcuate in lateral aspect; apex with a small acute ventral hook.

Ecology. The species has been collected from a variety of habitats including small, boggy seepages and small streams as well as ponds in both shaded and open sites.

Distribution. Map 160. This species has a wide range in eastern North America east of the Great Plains, extending from southern Ontario to Tennessee, and west of the Mississippi River in Arkansas, Mississippi and eastern Texas.



Map 160. *Agabus flavovittatus* **Larson and Wolfe. Canadian and Alaskan collection localities and United States state records.**

22. *Agabus texovittatus* Larson and Wolfe 1998

Figs. 130H; 131K

Agabus texovittatus Larson and Wolfe 1998: 46 – 47. Type locality - Texas, Houston, Bear Creek Park. Type in USNM.

Selected Reference. Larson and Wolfe 1998: 46 – 47.

Description. Length = 7.9 to 9.0 mm; width = 4.5 to 4.9 mm; length: depth = 3.14 to 3.33. Very similar to *A. flavovittatus*, differing slightly in some measurements, female sculpture and male protarsus and aedeagus.

Color as in *A. flavovittatus*, dorsal surface mainly black except head with frontal spots and anterior margin rufous; pronotum rufous laterally; elytron piceous laterally, sublateral vitta yellow, slightly narrowed medially and slightly expanded mesally at apex. Ventral surface and legs rufous to piceous. Antenna and palpi pale, without infuscation.

Sculpture of male similar to that of *A. flavovittatus*. Elytron with lines fine, forming small meshes of irregular size and shape, largest basomedially and smaller laterally and apically, meshes distinctly transverse in shape and orientation on apical half; punctures at intersections of lines small, obscure basally but more distinct laterally and apically. Female sculpture similar to that of male or with lines very slightly deeper but meshes not evidently granulate.

Metasternal wing broad, width metacoxa: width of metasternal wing = 2.78 to 3.23. Metatibial spur elongate, length metatibial spur: length metatarsomere 1 = 0.96 to 1.09.

Male protarsus narrower than *A. flavovittatus*, width protarsomere 1 = 0.17 to 0.20 mm; protarsal ratio = 2.03: 1.72:1.36: 1.17: 1; anterior protarsal claw (Fig. 130H) slightly more evenly arcuate in lateral aspect than that of *A. flavovittatus*, posterior claw narrow apically. Aedeagus (Fig. 131K) moderately elongate, length = 2.12 to 2.23 mm, apex with a small acute ventral hook; basal apophysis very small, basal piece in lateral aspect forming an acute angle with axis of shaft.

Ecology. Specimens from Houston, Texas, were collected from isolated, shaded pools situated in broad, shallow drainage ditches.

Distribution. The species is known only from Houston, Texas.

Agabus americanus-group

Fig. 132

Allogabus Guignot 1951: 84. Type species - *Agabus americanus* Aubé 1838, by original designation.

Diagnosis. Medium sized, length = 7.5 to 9.1 mm, elongate-oval and rather robust, lateral outline discontinuous with posterolateral angle of pronotum obtuse; color rufopiceous to piceous elytron lacking pale spots or submarginal vitta. Male with sculpture fine, elytron with fine lines and irregular meshes. Clypeus with anterior bead incomplete; frons lacking frontal punctures; pronotum (Fig. 132A, B) with anterior bead complete but fine, anterior submarginal row of punctures broadly broken medially; prosternum and its process in same plane in lateral aspect, process smoothly convex medially, its lateral bead broadly dilated behind procoxa; metasternum with impression of anteromedial process well developed, almost reaching level of hind margin of mesocoxal cavities. Metafemur without strioles. Metatibia with hind margin impunctate or with a few irregularly placed small punctures; longer metatibial spur shorter than metatarsomere 1; male protarsal claws (Fig. 132C, D) elongate, without a basal or subbasal tooth. Aedeagus (Fig. 132E, G) narrow, not twisted apically in dorsal aspect and without a subapical spine; paramere (Fig. 132I) strap-like, strongly sclerotized with a small apical lobe. Gonocoxa laterally flattened, lightly sclerotized and setose, without a lateral ridge or carina.

Comments. This group contains two Central American species. These insects superficially resemble the boreal species *A. opacus* in general size and habitus and even show similarity in sexual dimorphism of sculpture. However they differ in the shape of the prosternal process and characteristics of the male and female genitalia indicating the relationship is not close. The inflated prosternal bead is shared with the *semivittatus*-, *spinipes*-, and *confusus*-groups. Amongst these, the greatest similarity is with the members of the *spinipes*-group which have a similarly narrowed pronotum and an aedeagus of somewhat similar basic form. However, members of the *spinipes*-group are smaller and have reduced secondary sexual characteristics and less modification of the legs for swimming. The two groups probably share a common ancestor but the *spinipes*-group has become modified for an interstitial life along margins of small streams whereas members of the *americanus*-group have retained more ancestral *Agabus* characteristics.

23. *Agabus americanus* Aubé 1838
Fig. 132A – C, E, F

Agabus americanus Aubé 1838*b*: 334 – 335. Type locality - Mexico.

Description. Length = 7.8 to 9.1 mm; width = 4.0 to 4.5 mm; length: width = 1.94 to 2.07. Body relatively robust, lateral outline discontinuous in dorsal aspect.

Color mainly rufopiceous to piceous, even darkest specimens with faint reddish color. Head with large red frontal spots; anterior margin reddish; palpi and antenna reddish, without infuscation. Pronotum with lateral margin broadly reddish to piceous. Elytron with lateral margin piceous, epipleuron reddish. Ventral surface mainly piceous, abdominal sterna extensively reddish laterally and posteriorly. legs rufous to piceous.

Male dorsal surface shiny, head and pronotum with fine lines forming meshes of moderate size and varied, irregular shape, somewhat longitudinally stretched medially on pronotum of some specimens; small punctures present at some intersections of lines and sparsely on some meshes. Elytron with lines very lightly impressed, meshes of irregular size and shape basally and medially, smaller and more regular laterally and apically; minute punctures present in some meshes. Metacoxal plate with coarse microreticulation arranged in more or less longitudinal series but without well defined coarser lines. Metafemur without strioles. Female like male and shiny or most specimens with dorsal surface matte, pronotum and elytron with dense, fine longitudinal lines and interspaces strongly microreticulate.

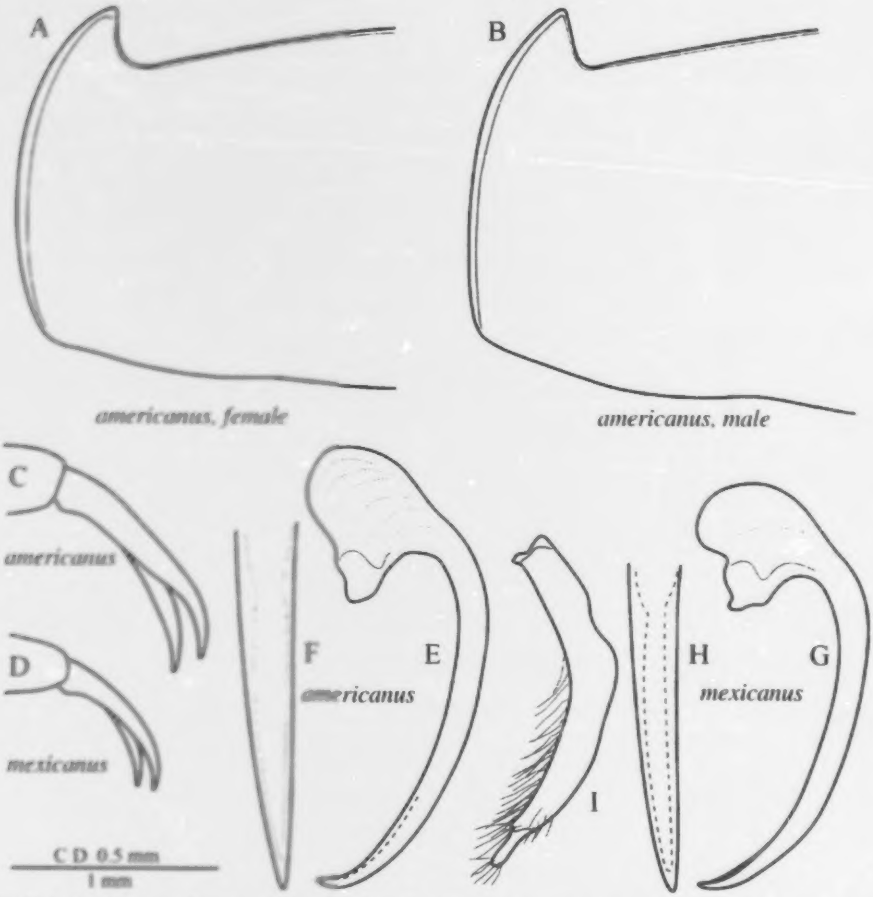


Fig. 132. *Agabus americanus*-group. A - C, E, F - *A. americanus*. A - pronotum, female. B - pronotum, male. C - protarsal claws, anterior. E - aedeagus, lateral. F - aedeagus apex, dorsal. D, G - I - *A. mexicanus*. D - protarsal claw, anterior. G - aedeagus, lateral. H - aedeagus, dorsal. I - paramere.

Pronotum (Fig. 132A, B) with posterolateral angle obtuse, more rounded in female than male; lateral margin in lateral aspect slightly reflexed upwards anteriorly and exposing proepipleuron. Prosternum and its process in same plane in lateral aspect, process smoothly and lowly convex medially, lateral bead inflated posterior to procoxae, apex of process bluntly pointed. Width of metacoxal plate: width metasternal wing = 2.75 to 3.10. Metafemur broad, length: width = 2.66 to 2.92, slightly broader on average in male than in female. Metatibia length: width = 4.52 to 5.20; metatibial spurs short, length of longer spur: length metatarsomere 1 = 0.67 to 0.80.

Male protarsus moderately dilated, width protarsomere 1 = 0.21 to 0.27 mm; protarsal ratio = 1.90: 1.57: 1.15: 1.01: 1; protarsal claws (Fig. 132C) elongate, subequal in length to length of protarsomere 5. Length mesotarsomere 5: combined length mesotarsomeres 1 to 4 = 0.60 to 0.70. Paramere strap-like, strongly sclerotized with a small apical lobe; aedeagus (Fig. 132E, F) strongly sclerotized, narrow and arcuate in lateral aspect with reflexed apex, not twisted in dorsal aspect.

Ecology. Collection label on three specimens states "ne slope Volcan Tacana, leaf litter in wet ravine. Alnus, bamboo 2800 m" (H. Frania and J. Belicek collectors, UASM). The species is probably lotic, occurring in small mountain streams.

Distribution. Specimens have been examined from the states of Chiapas and Oaxaca of Mexico and from Guatemala.

24. *Agabus mexicanus* Larson, new species

Fig. 132D, G – I

HOLOTYPE. Male labelled: Mexico, Mich.[oacan] 3 miles w Puerta Carnica, xii 1948, H. B. Leech. Specimen deposited in CASC.

PARATYPE. Male labelled: Mexico, Michoacan 20 km E Morelia 2100 m, Hwy. 15, 20.VI.1986, M. Sörenson and B. Mårtensson. Specimen in LUND.

Description. (Based on two male specimens). Very similar to *A. americanus*, only points of difference described. Length = 7.5 and 8.1 mm; width = 3.8 and 4.2 mm; length: width = 1.93 and 1.96.

Metasternal wing broader, width metacoxal plate: width metasternal wing = 2.25, 2.67.

Male protarsomeres narrower, width protarsomere 1 = 0.17 and 0.19 mm; protarsal ratio = 1.73, 1.91: 1.45, 1.73: 1.18, 1.27: 1.09, 1.18: 1; protarsal claws (Fig. 132D) shorter, 0.6 to 0.7 length of protarsomere 5. Aedeagus (Fig. 132G, H) in lateral aspect slenderer, not so strongly curved apically.

Comments. The members of the *A. americanus*-group are poorly represented in collections. It is likely that the complex will be found to be more widely distributed in the mountains of Mexico and Central America and that various geographical forms will be discovered. This species is apparently a regional representative of the group. It is similar to *A. americanus* but the diagnostic features, namely width of metasternal wing, width of male protarsomeres and slight differences in the protarsal claws and shape of the aedeagus are the sort of characteristics that define other species within the genus and therefore it is justifiable to recognize the two known specimens as a distinct species.

Ecology. The habitat is unknown.

Distribution. Known from the state of Michoacan, Mexico.

Agabus spinipes-group

Figs. 133; 134

Diagnosis. Small species, length = 5.8 to 7.4 mm, body rather stout, with a distinct discontinuity in outline between pronotum and elytra. Color mainly rufopiceous to black, elytron without pale spots or with a faintly rufescent sublateral vitta. Sculpture relatively coarse, meshes small and irregular in shape to more or less granular, some individuals with punctures visible at intersections of lines on head and pronotum; metafemur lacking strioles. Clypeal bead broadly broken medially. Frons without frontal punctures. Antenna relatively stout. Pronotum with anterior marginal bead obsolete medially, anterior

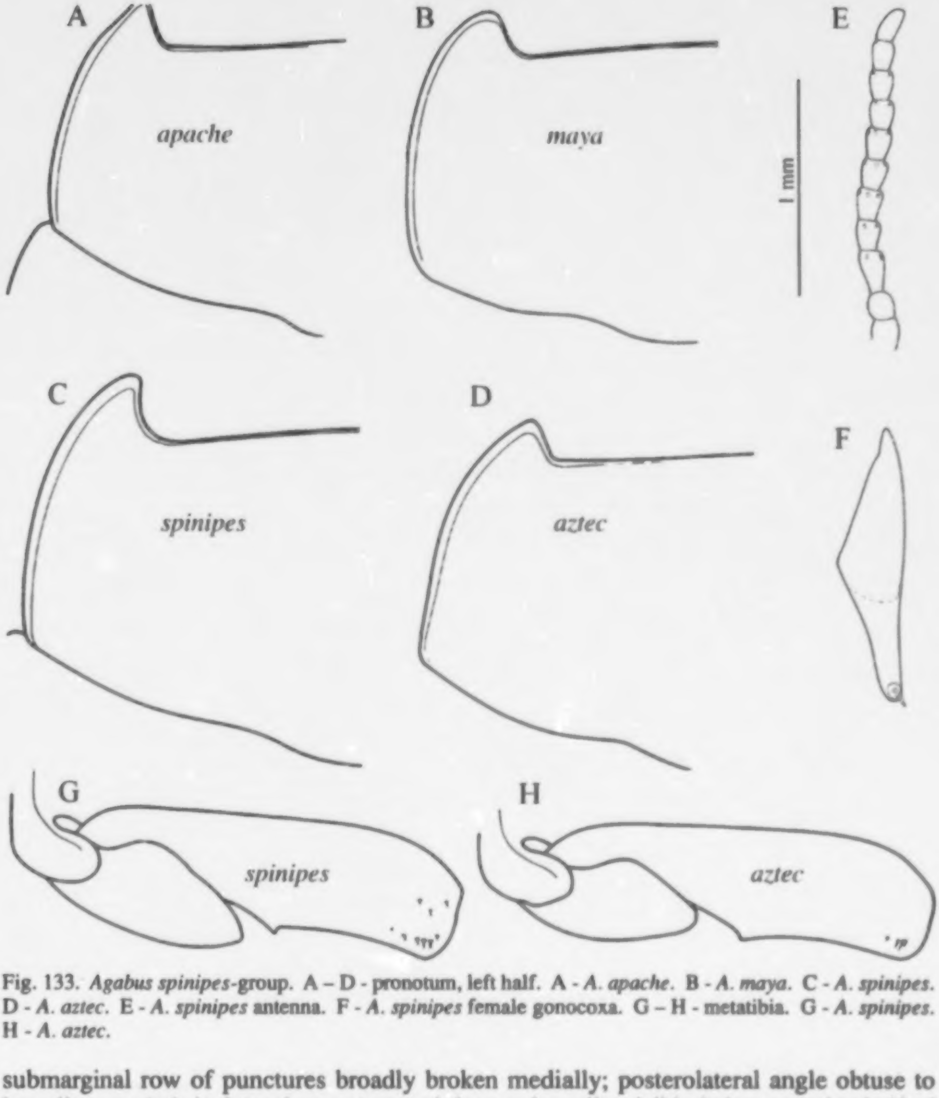


Fig. 133. *Agabus spinipes*-group. A – D - pronotum, left half. A - *A. apache*. B - *A. maya*. C - *A. spinipes*. D - *A. aztec*. E - *A. spinipes* antenna. F - *A. spinipes* female gonocoxa. G – H - metatibia. G - *A. spinipes*. H - *A. aztec*.

submarginal row of punctures broadly broken medially; posterolateral angle obtuse to broadly rounded; in lateral aspect proepipleuron broadly visible below anterior half of lateral margin. Prosternum and its process in same plane, process short and ovate to longer and broadly lanceolate, surface almost flat to lowly convex, lateral bead strongly inflated basally. Metasternum with anteromedial impression variously developed, short to almost reaching level of hind margin of mesocoxal cavities; metasternal wings broad. Metafemur with setae of posteroapical angle rather irregularly arranged; metatibia with a more or less complete row of separated punctures along posteroventral margin, mesal face with irregular punctures along most of length; longer metatibial spur slightly shorter than metatarsomere 1. Metatarsomeres 1 to 3 without dorsal setiferous punctures but with confusedly spaced stout setae along outer margin. Male protarsomeres narrowly dilated, tarsomeres 1 or 1 and 2 only with a small patch of yellow adhesive setae on ventral surface; anterior protarsal claw simple or toothed; metatibia and metatarsomeres lacking natatorial setae. Parameres (Fig. 134D, I, M) stylate, basal sclerite broad and

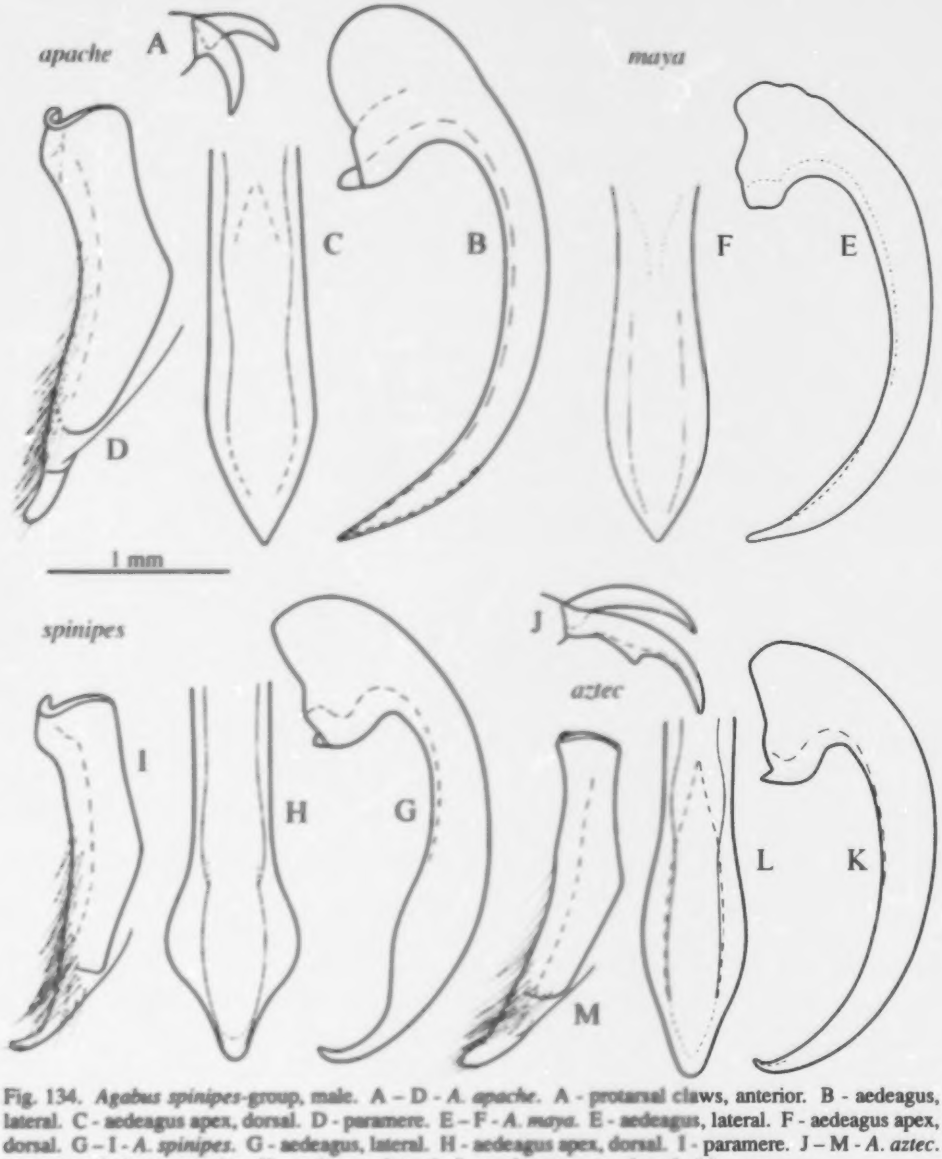


Fig. 134. *Agabus spinipes*-group, male. A – D - *A. apache*. A - protarsal claws, anterior. B - aedeagus, lateral. C - aedeagus apex, dorsal. D - paramere. E – F - *A. maya*. E - aedeagus, lateral. F - aedeagus apex, dorsal. G – I - *A. spinipes*. G - aedeagus, lateral. H - aedeagus apex, dorsal. I - paramere. J – M - *A. aztec*. J - protarsal claws, anterior. K - aedeagus, lateral. L - aedeagus apex, dorsal. M - paramere.

long, stylus short and slender; aedeagus dorsoventrally flattened, subapically expanded laterally, apex symmetrical. Female gonocoxa (Fig. 133F) elongate and narrowed apically, with short setae, not strongly sclerotized and without an external ridge.

Comments. The members of this group are distinctive because of their small size, discontinuous shape, stout antennae and coarse sculpture. The inflated lateral margin of the pronotal bead suggests a relationship with the *semivittatus*-group (Larson and Wolfe 1998).

The species of this group occur in small mountain streams and springs of the southwestern United States and Mexico. The beetles have been found at the water's edge, under rocks or in moss and debris. Young (1981d) noted that the swimming hairs of the legs are reduced whereas the tarsal claws are rather large and suggested that the beetles probably crawl over the bottom aided by the large tarsal claws rather than doing much swimming. The bodies of many specimens are encrusted in iron precipitate or silt-like material which adheres to the rough sculpture.

25. *Agabus apache* Young 1981

Figs. 133A; 134A – D

Agabus apache Young 1981*d*: 349 – 351. Type locality – Rustler's Park (elevation about 8000 feet), Cochise Co., Chiricahua Mountains, Arizona.

Selected References. Fall 1922: 9 – 10 (as *A. spinipes*); Young 1981*d*: 349 – 351.

Description. Length 5.8 to 7.3 mm, width = 3.2 to 3.8 mm, length: width = 1.80 to 1.91. Body outline discontinuous.

Color mainly rufopiceous to black. Head with frontal spots, clypeus and mouthparts reddish; antenna reddish brown but without distinct infuscation. Pronotum and elytra laterally reddish, elytron of many specimens with a vague reddish sublateral vitta on apical third. Legs reddish brown.

Head and pronotum with deeply impressed lines forming small meshes of varied size and irregular shape; elytron with sculpture consisting of small flattened meshes separated by granules giving surface a matte appearance. Metacoxal plate microreticulate with anastomosing deeper lines medially and with shallow, transverse rugae. Sternum 6 microreticulate with sculpture coarsely granulate medially and apically, lacking longitudinal rugae.

Antennae (Fig. 133E) stout, middle antennomeres about as wide as long; palpi short and stout. Pronotum (Fig. 133A) with lateral bead narrow but sharply raised throughout its length, many females with lateral margin on anterolateral angle slightly impressed and sinuate; posterolateral angle distinct but obtuse; in lateral aspect lateral margin curved up at anterior angle and broadly exposing proepipleuron. Prosternal process relatively short and bluntly pointed, surface smoothly convex and finely punctate, lateral bead broadly inflated posterior to procoxae. Metasternum with anteromedial impression short and not reaching level of hind margin of mesocoxal cavities; width metacoxa: width of metasternal wing = 1.63 to 2.08. Legs slender, metafemur length: width = 3.43 to 3.84; metatibial spur short, length metatibial spur: length metatarsomere 1 = 0.70 to 0.82.

Male protarsus narrow, width protarsomere1 = 0.16 to 0.18 mm, protarsal ratio = 1.82: 1.56: 1.22: 1.10: 1; ventrally protarsomere 1 on apical third and protarsomere 2 with small yellow adhesive setae; protarsal claws (Fig. 134A) short, anterior slightly broader than posterior. Mesotarsomeres 1 and 2 lacking ventral adhesive setae but each with a patch of unmodified yellow setae; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.54 to 0.76. Male metafemur without an angulation or tooth on hind margin distad of apex of trochanter. Aedeagus (Fig. 134B, C) dorsoventrally flattened, in dorsal aspect slightly broadened at apical third than evenly narrowed to acutely pointed apex.

Ecology. Young (1981*d*) recorded the type series as crawling around on the bottom of pools in a small, cold, spring-fed stream. In southern New Mexico, specimens were collected from amongst mosses and under cover at the margin of a small, turbulent, mountain stream.

Distribution. This species occurs in southern New Mexico, Arizona and northern Mexico.

26. *Agabus maya* Larson, new species

Figs. 133B; 134E, F

HOLOTYPE. Male, labelled: Mexico, Chiapas Union Juarez, n.e. slope Volcan Tacana, leaf litter in wet ravine *Alnus*, bamboo 2800m. Dec. 22, 1975/ 1975 MEX. EXP. H. E. Frania & J. Belicek collectors. Deposited in USNM.

ALLOTYPE. Female - same collection data as holotype. Deposited in USNM.

PARATYPES. Same collection data as holotype (1male, 5 females); same locality, leaf litter on ridge cloud forest, 2450 m, Dec. 23, 1995 (1 male, 3 females). Specimens in CASC, CNC and USNM.

Description. Length = 6.1 to 6.6 mm; width = 3.1 to 3.3 mm; length: width = 1.91 to 2.05. Similar to *A. apache* but slenderer, dorsal surface shinier and pronotal hind angles more obtuse.

Color mainly rufopiceous to black. Head with frontal spots, clypeus and mouthparts reddish; antenna and palpi dark reddish, without distinct infuscation. Pronotum with lateral bead and narrow hind margin translucent and rufous. Elytra laterally reddish, elytron dark rufous to piceous, many specimens with a vague reddish sublateral vitta on apical third. Legs reddish brown.

Sculpture of head and pronotum similar in form to that of *A. apache* but lines finer and shallower, especially medially on pronotum, small punctures evident at some intersections. Elytron with small meshes of varied shape but approximately similar size, their surface smooth or with obsolete microreticulation and minute punctures and somewhat shiny. Metacoxal plate with fine longitudinal lines and shallow transverse rugae, without anastomosing deeper lines medially. Sternum 6 microreticulate, sculpture coarser medially and apically and granular on some specimens, lacking longitudinal rugae.

Antennae stout, middle antennomeres about as wide as long; labial palpus with apical palpomere slenderer that of *A. apache*. Pronotum (Fig. 133B) with lateral margin less arcuate than *A. apache*, lateral bead broader, female with lateral margin on anterolateral angle not impressed or sinuate; posterolateral angle broadly obtuse to more or less rounded; in lateral aspect lateral margin curved up at anterior angle and broadly exposing proepipleuron. Prosternal process cordate, short and bluntly pointed, surface with low, smooth convexity, finely punctate, lateral bead broadly inflated posterior to procoxae. Metasternum with anteromedial impression short and not reaching level of hind margin of mesocoxal cavities; width metacoxa: width of metasternal wing = 1.75 to 2.05. Legs slender, metafemur length: width = 3.07 to 3.46; metatibial spur short, length metatibial spur: length metatarsomere 1 = 0.76 to 0.88.

Male protarsus broader, width protarsomere 1 = 0.18 to 0.21 mm; protarsal ratio = 1.98: 1.68: 1.30: 1.14: 1; ventrally protarsomere 1 on apical third and protarsomere 2 with small yellow adhesive setae; anterior protarsal claw not toothed. Mesotarsomeres 1 and 2 with ventral adhesive setae; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.63 to 0.71. Male metafemur without an angulation or tooth on hind margin distad of apex of trochanter. Aedeagus (Fig. 134E, F) similar in shape to that of *A. apache* but more strongly arcuate apically in lateral aspect, in dorsal aspect more abruptly pointed.

Etymology. This species is named after the Maya people of Mexico and Guatemala.

Ecology. Collection labels state "leaf litter in wet ravine, *Alnus*, bamboo 2800 m" and "leaf litter on ridge cloud forest, ele. 2450 m". The beetles probably occur in small springs and headwater streams. All specimens were collected 22 and 23 December, and some were teneral.

Distribution. The species is known only from the northeast slope of Volcan Tacana, Chiapas, near the Mexico – Guatemala border.

27. *Agabus spinipes* Sharp 1882

Figs. 133C, E, F, G; 134G – I

Agabus spinipes Sharp 1882*b*: 32 – 33. Type locality - Oaxaca, Mexico.

Selected Reference. Young 1981*d*: 349.

Description. Similar to *A. apache*, recognizable with certainty only on the basis of male characteristics. Length = 6.1 to 7.4 mm; width = 3.3 to 4.0 mm; length: width = 1.77 to 1.88.

Color similar to *A. apache*.

Sculpture similar to *A. apache* but on average lines not as deep and meshes not as coarse, elytron with meshes on average larger and pattern of large flat and smaller granular meshes less regular.

Pronotum (Fig. 133C) of female with lateral margin not impressed on anterolateral angle; posterolateral angle distinct but obtuse; lateral margin in lateral aspect almost straight or only slightly curved up at anterior angle and only narrowly exposing proepipleuron. Prosternal process relatively short, surface smoothly convex medially. Metasternum with anteromedial impression not reaching level of hind margin of mesocoxal cavities; width metacoxa: width of metasternal wing = 1.75 to 1.93. Metafemur (Fig. 133G) relatively broad, especially male in which hind margin is produced as a small tooth distad to apex of trochanter; metafemur length: width = 2.76 to 3.52; metatibial spur short, length metatibial spur: length metatarsomere 1 = 0.65 to 0.79.

Male protarsus relatively narrow, width protarsomere 1 = 0.16 to 0.20 mm, protarsal ratio = 1.80: 1.54: 1.26: 1.08: 1; ventrally protarsomere 1 on apical third and protarsomere 2 with adhesive setae; also mesotarsomeres 1 and 2 with adhesive setae. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.65 to 0.71. Aedeagus (Fig. 134G, H) in lateral aspect with apex strongly curved and ventral surface swollen at base of apex; in dorsal aspect very broadly swollen subapically.

Distribution. In addition to the type locality, specimens have been examined from: MEXICO: Guerrero, 26 km ne El Paraiso, 1800 m, 8 Aug. 1986, R. Davidson, J. Rawlings (3, UASM); Jalisco, 17 miles sw Atenquique, XII 2, 48, se slope Mt. Colima, H. B. Leech. (23, CASC). A female specimen from Veracruz (Coscomatepec (6 km N), Rio Jamapa, May 26, 1981, P.J. Spangler, USNM) is not identical and may represent another species although male specimens are required for positive identification.

28. *Agabus aztec* Larson, new species

Figs. 133D, H; 134J – M

HOLOTYPE - male, labelled: MEX. Puebla 50.8 km s.e. Azumbilla 2480 m., oak-pine forest, logs, ground 78B-36a Dec. 24-25, 1978/ MEXICAN EXP. 1978-1979 G.E .& K.E. Ball collectors. Deposited in USNM.

Description. Described from holotype only. Length = 6.8 mm; width = 3.5 mm; length: width = 1.96.

Color similar to *A. apache* and *A. spinipes*, mainly piceous to black.

Sculpture relatively shallow and body shiny. Head and pronotum medially with punctures evident in many intersections of lines; pronotum medially with lines shallow and irregularly transverse, deeper and more irregular towards margins and lateral areas of disc coarsely granular. Elytron with meshes of varied shape but approximately similar size, without small, granular meshes separating larger flattened meshes.

Pronotum (Fig. 133D) in dorsal aspect with lateral margin smoothly curved anteriorly, becoming straighter posteriorly, pronotum narrower at base than elytra across humeral angles, posterolateral angle distinct but obtuse; in lateral aspect lateral margin strongly curved upwards on anterolateral angle and broadly exposing proepipleuron. Prosternal process relatively elongate and narrow, bluntly pointed apically, surface smoothly convex, lateral bead broadly dilated basally. Metasternum with anteromedial impression almost attaining level of hind margin of mesocoxae; width metacoxa: width of metasternal wing = 1.77. Metafemur (Fig. 133H) with a broad, blunt tooth on ventral margin distad of apex of trochanter, length: width = 3.00; metatibial spur short, length metatibial spur: length metatarsomere 1 = 0.76.

Male width protarsomere 1 = 0.19 mm; protarsal ratio = 1.62: 1.38: 1.08: 1: 1; protarsomere 1 on apical third and protarsomere 2 with adhesive setae ventrally; anterior protarsal claw (Fig. 134J) longer and broader than posterior claw, with a small acute midventral tooth. Mesotarsomeres 1 and 2 each with adhesive setae ventrally; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.66. Aedeagus (Fig. 134K, L) in lateral aspect with apex strongly curved, ventral surface flat and not inflated subapically; in dorsal aspect broadened subapically, sides slightly sinuate towards apex.

Etymology. The name refers to the Aztec people who were dominant in the Puebla region of Mexico prior to the Spanish conquest.

Ecology. Water is not mentioned in the label habitat description but the species could typically inhabit small springs and streams like other members of the group.

Distribution. Known only from the type locality in Puebla, Mexico.

Agabus confusus-group

Fig. 135

Diagnosis. Largest North American *Agabus* species, length = 9.9 to 12.5 mm. Body broadly oval, outline continuous. Color rufopiceous to black, elytron with a small, oval sublateral pale spot behind middle. Sculpture with lines densely punctate. Metafemur without strioles. Clypeal bead broadly broken medially. Frons with frontal punctures absent. Pronotum with anterior bead obsolete medially, anterior submarginal row of punctures broadly discontinuous medially; lateral bead very broad. Prosternum and its process in same plane; prosternal process large, apex sharply pointed, lateral bead strongly inflated posterad to procoxae. Metasternum with anteromedial impression extending to level of hind margin of mesocoxae; metasternal wing moderately narrow. Metatibia with a row of separated punctures along posteroventral margin, mesal face with sparse, irregular punctures along most of length. Longer metatibial spur subequal in length to metatarsomere 1. Metatarsomeres without dorsal setiferous punctures. Aedeagus broadened apically and with apex asymmetrically bilobed in dorsal aspect. Gonocoxa (Fig. 135E) laterally flattened, with apex elongate and setose.

Comments. The systematic position of this species is uncertain. In many characters it resembles members of the *seriatus*-group but in the expanded bead of the prosternal process and several other features the species resembles members of the *semivittatus*-group (Larson and Wolfe 1998). The members of the three groups are lotic. The unique form of aedeagus and several distinctive features of the larva indicate *A. confusus* occupies a rather isolated position.

29. *Agabus confusus* (Blatchley 1910)

Fig. 135

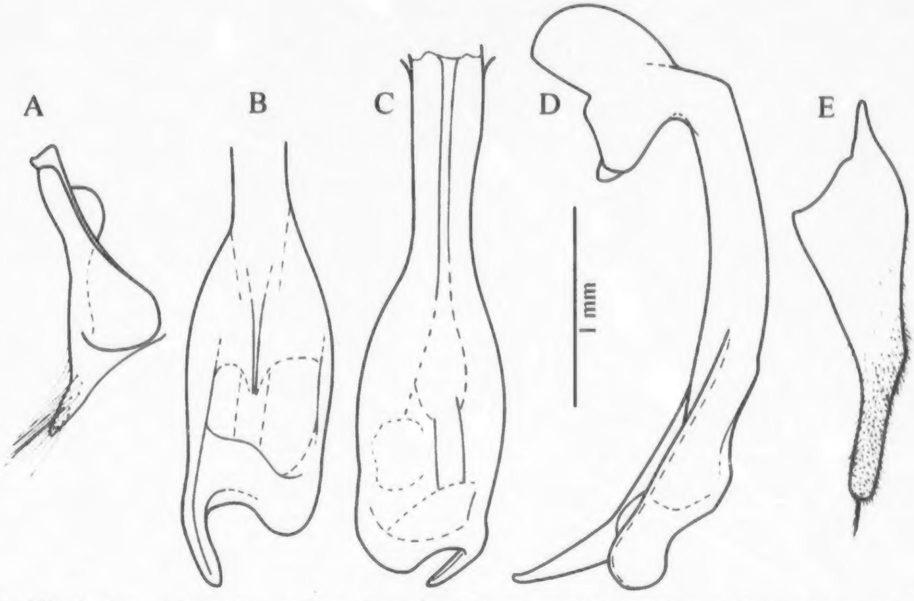


Fig. 135. *Agabus confusus*. A - paramere. B - aedeagus apex, ventral. C - aedeagus, dorsal. D - aedeagus, lateral. E - female gonocoxa.

Rhantus confusus Blatchley 1910: 229. Type locality - Ohio River, Floyd Co., Indiana.

Agabus ampulus Fall 1922: 10, 12. Type locality - Missouri. Type - MCZC, male, no. 23967, examined.

Selected References. Fall 1922: 10, 12 (as *A. amplus* Fall); Young 1953*a*: 117; Hilsenhoff 1974: 703 – 705; Hilsenhoff 1993*c*: 183.

Description. Length = 9.9 to 12.5 mm; width = 5.6 to 6.8 mm, length: width = 1.78 to 1.90. Size very large, body outline continuous, subparallel medially and many specimens with point of maximum width shortly behind elytral shoulders.

Color rufopiceous to almost black. Frontal spots, anterior margin of clypeus and lateral margins of pronotum and elytra slightly paler. Each elytron with a small, oval, postmedial spot which is well removed from lateral margin.

Sculpture of elytron consisting of irregular polygonal meshes of moderate size, basomedially with some fusion of adjacent meshes and apically meshes slightly transverse; lines densely punctate with a puncture at each intersection as well as along lines; meshes flat and smooth. Metacoxal plate with lines irregularly longitudinal and variously interrupted, strongly punctate.

Pronotum with lateral bead very broad, at widest point wider than maximum width of a medial antennomere; posterolateral angle produced and acute, basal margin strongly bisinuate each side of middle; lateral margin in lateral aspect hiding proepipleuron. Prosternum and its process in same plane in lateral aspect, broadly and smoothly convex medially; process with lateral bead strongly inflated posterad to procoxae, apex sharply pointed and received into deeply incised anteromedial metasternal impression which extends posteriorly to level of hind margin of mesocoxal cavities. Metasternal wing moderately narrow, width metacoxa: width of metasternal wing = 2.95 to 3.42. Legs moderately narrow, metafemur length: width = 2.75 to 3.45, metatibia length: width = 3.32 to 3.89; metafemur with small punctures, lacking strioles; metatibia with a complete row of separated punctures along posteroventral margin, ventral face with sparse punctures along its length; length metatibial spur length to metatarsomere 1 = 0.88 to 1.04. Metatarsomeres lacking ventrolateral setae, male with natatorial setae on metatarsomeres 1 to 3.

Male protarsus slightly broadened, width protarsomere 1 = 0.22 to 0.25 mm, protarsal ratio = 1.64: 1.54: 1.36: 1.13: 1; protarsomeres 1 to 3 ventrally with small, oval, adhesive setae of similar size; protarsal claws subequal in length, anterior claw broadly expanded ventrally but not distinctly toothed. Mesotarsus not elongate, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.50. Sternum 6 with a few irregular, longitudinal rugae along posterolateral margin. Paramere (Fig. 135A) stylate, basal sclerite large and rectangular, stylus short with apical sclerite large; aedeagus (Fig. 135B - D) very peculiarly modified, in dorsal aspect widened apically, apex with a curved finger-like process on right side and a short rounded lobe on left.

Ecology. This is a lotic species. Hilsenhoff (1993*c*) reported collecting adults and larvae from under grass-covered banks in an area of rapid current of a small rocky creek. Both larvae and adults overwinter. Hilsenhoff (1974) described the larva.

Distribution. This species has a limited range in the eastern United States, occurring from southern Wisconsin to Kentucky, Missouri, and Arkansas.

Agabus seriatus-group
Figs. 136 – 139

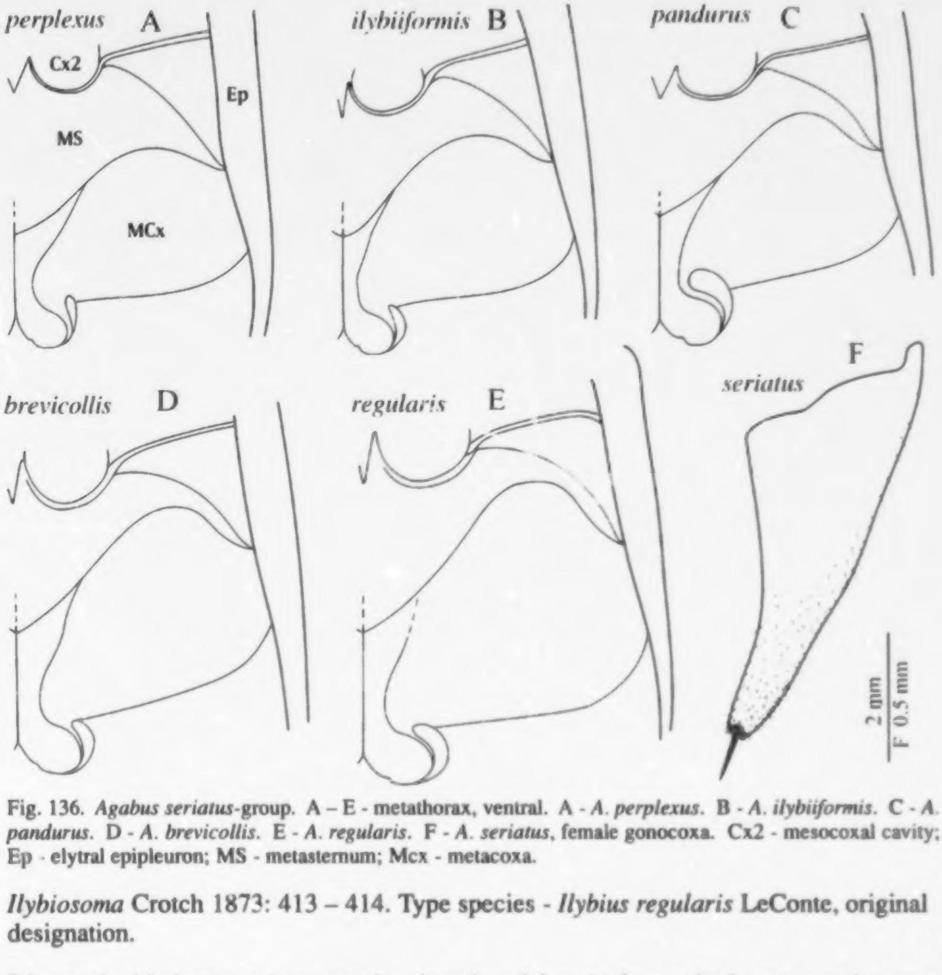


Fig. 136. *Agabus seriatus*-group. A – E - metathorax, ventral. A - *A. perplexus*. B - *A. ilybiiformis*. C - *A. pandurus*. D - *A. brevicollis*. E - *A. regularis*. F - *A. seriatus*, female gonocoxa. Cx2 - mesocoxal cavity; Ep - elytral epipleuron; MS - metasternum; Mcx - metacoxa.

Ilybiosoma Crotch 1873: 413 – 414. Type species - *Ilybius regularis* LeConte, original designation.

Diagnosis. Moderate to large species, length = 6.8 to 11.3 mm, body ovate and convex dorsally to parallel-sided medially and depressed (Fig. 138). Color rufopiceous to black, nonmaculate except elytron with a small, elongate sublateral pale spot behind middle but spot may be visible only when elytron is lifted on some dark specimens. Dorsal surface with sculpture various; lines, where shallowly impressed or obsolete, with punctures at intersections and along lines. Clypeal bead broadly broken medially. Frons with frontal punctures present. Pronotum with anterior submarginal row of punctures complete, anterior marginal bead obsolete medially. Prosternum and its process in more or less same plane; prosternal process large, apex acuminate; convexity of surface various, from more or less flat to broadly tectiform; lateral bead narrow. Metasternum with anteromedial impression extending posteriorly to or almost to level of hind margin of mesocoxae; metasternal wing various, broad to very narrow (Fig. 136A - E). Metatibia with a complete row of punctures along posteroventral margin, mesal face with irregular series of punctures along most of length. Longer metatibial spur shorter than to distinctly longer than metatarsomere 1. Metatarsomeres without dorsal setiferous punctures. Male protarsomeres 1 to 3 narrowly dilated, with small oval scales beneath, scales of similar size or with a few slightly larger scales apically on each tarsomere. Anterior protarsal claw, when modified, broadened, with a shelf extending ventrally from anterior margin, in some specimens large enough to be considered tooth-like; some specimens with ventral surface of claw posterad to shelf excavate. Parameres stylate, basal sclerite elongate and strap-like; aedeagus narrow, without a subapical spine, in dorsal aspect apex curved to right. Female ovipositor with gonocoxae (Fig. 136F) elongate and narrowed apically, with dense, short setae; not strongly sclerotized and without an external ridge.

Comments. The group is endemic to North America. The species are lotic, occurring in springs, small streams and at the margin of larger streams. All species are western with the range of only one, *Agabus seriatus*, extending east of the Great Plains. The group has been revised by Larson (1997*a*).

30. *A. lugens* LeConte 1852: 203

Fig. 137A, B

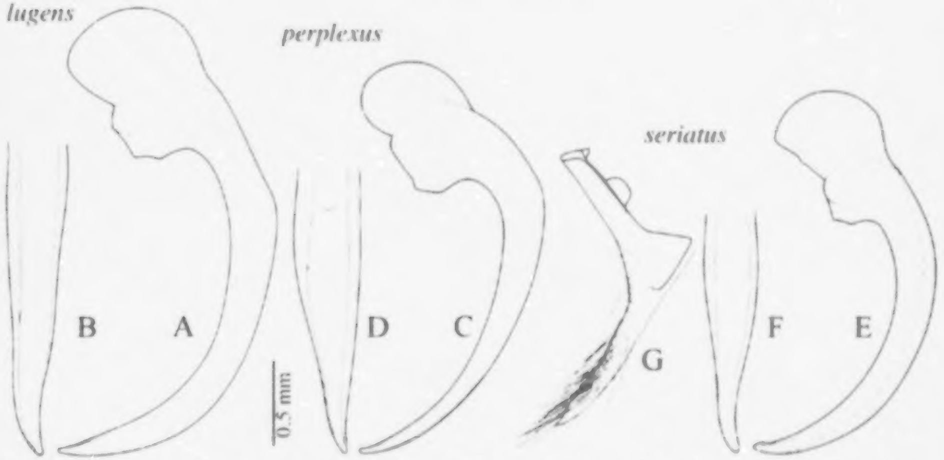


Fig. 137. *Agabus seriatus*-group, *seriatus*-subgroup. A – B - *A. lugens*. A - aedeagus, lateral. B - aedeagus apex, dorsal. C – D - *A. perplexus*. C - aedeagus, lateral. D - aedeagus apex, dorsal. E – G - *A. seriatus*. E - aedeagus, lateral. F - aedeagus apex, dorsal. G - paramere.

Agabus lugens LeConte 1852: 203. Type locality – Lectotype from New Mexico (Larson 1997*a*).

Selected Reference. Larson 1997*a*: 112 – 115.

Description. Length = 7.8 to 10.4 mm; W = 4.3 to 5.5 mm; length: width = 1.76 to 1.97. Shape broadly oval, depressed, lateral margin of pronotum and elytra more or less continuous and evenly arcuate.

Color black. Head with frontal spots dark rufous, barely visible on many specimens; antenna rufous basally, antennomeres 2 or 3 to 11 infuscate and piceous medially and apically; palpomeres infuscate, at least apical palpomere of each palpus dark rufous to piceous. Pronotum black with posterolateral margin and hind angles piceous. Elytron black, with a small elongate sublateral yellow spot posterad of middle but spot may be visible only when elytron is lifted on some specimens. Ventral surface and legs piceous to black.

Elytron with meshes small, of varied size and shape; lines shallow and meshes flat medially; lines deeper, meshes more irregular in size and slightly convex to granular laterally and apically; lines with small, often obscure punctures at intersections, many meshes with one or two small punctures. Metacoxal plate with irregular somewhat elongate meshes. Metafemur with elongate, oblique meshes but without lines deepened to form discrete strioles; with small, more or less evenly spaced punctures. Sternum 6 with sculpture coarser along posterolateral margin and forming shallow irregular longitudinal grooves encompassing setiferous punctures.

Pronotum broad, lateral margin broadly and evenly arcuate, more or less continuous in curvature with lateral margin of elytron; posterolateral angle right angled to slightly acute but with apex narrowly rounded; basal margin slightly sinuate each side of middle; lateral bead well defined and elevated slightly from level of disc, approximately two-thirds width of medial antennomere but variously narrowed on anterolateral and posterolateral angles; in lateral aspect, lateral margin straight to slightly arcuate, proepipleuron narrowly visible below anterolateral angle. Prosternum tectiform in cross section, process less strongly convex and more evenly rounded, flattest basally, more convex apically; apex acute. Metasternal wing broad, width metacoxa: width of metasternal wing = 1.72 to 2.16. Hind legs slender, metafemur length: width = 3.02 to 3.47; metatibia length: width = 4.23 to 4.72. Metatibia ventrally with a complete row of moderate sized, distinctly separated punctures along posterior margin, medially with coarser punctures irregularly scattered along most of length. Length metatibial spur: length metatarsomere 1 = 0.80 to 0.92.

Male protarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.16 to 0.20 mm; protarsal ratio = 1.76: 1.64: 1.38: 1.12: 1; protarsomeres 1 to 3 bearing small, oval, more or less equal sized adhesive setae. Protarsal claws subequal in length, similarly arcuate, anterior claw broader, expanded ventrally, on some specimens forming a low, obtuse ventrobasal tooth. Mesotarsomeres 1 to 3 slightly dilated, with small adhesive setae beneath; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.47 to 0.54. Aedeagus (Fig. 137A, B) in lateral aspect more or less evenly curved basally; in dorsal aspect with left side less broadened medially and less strongly sinuate apically than in *A. perplexus*.

Comments. Larson (1997a) demonstrated that *A. lugens* and *A. perplexus* are best recognized as separate, largely parapatric species.

Ecology. These beetles occur on mineral substrates such as rubble, gravel or sand in springs and small streams.

Distribution. The range extends from South Dakota and Colorado south to Texas and Mexico and west to California and eastern Oregon. The species reaches the Pacific coast in southern California but otherwise occurs east of the Sierra Nevada and Coast Range Mountains.

31. *Agabus perplexus* Sharp 1882

Fig. 136A, 137C, D

Agabus perplexus Sharp 1882*a*: 498. Type locality – Lectotype from Vancouver Island (Larson 1997*a*).

Selected Reference. Larson 1997*a*: 115 – 117.

Description. Length = 7.9 to 9.8 mm; width = 4.4 to 5.3 mm; length: width = 1.74 to 1.94. Indistinguishable from *A. lugens* except for male genitalia. Shape broadly oval, depressed, lateral margins of pronotum and elytra more or less continuous and evenly arcuate.

Color mainly black as in *A. lugens*. Antennomeres 2 or 3 to 11 infuscate and piceous medially and apically; palpi infuscate, at least apical palpomere of each palpus dark rufous to piceous. Elytron black, with a small elongate sublateral yellow spot posteriad of middle but spot may be visible only when elytron is lifted.

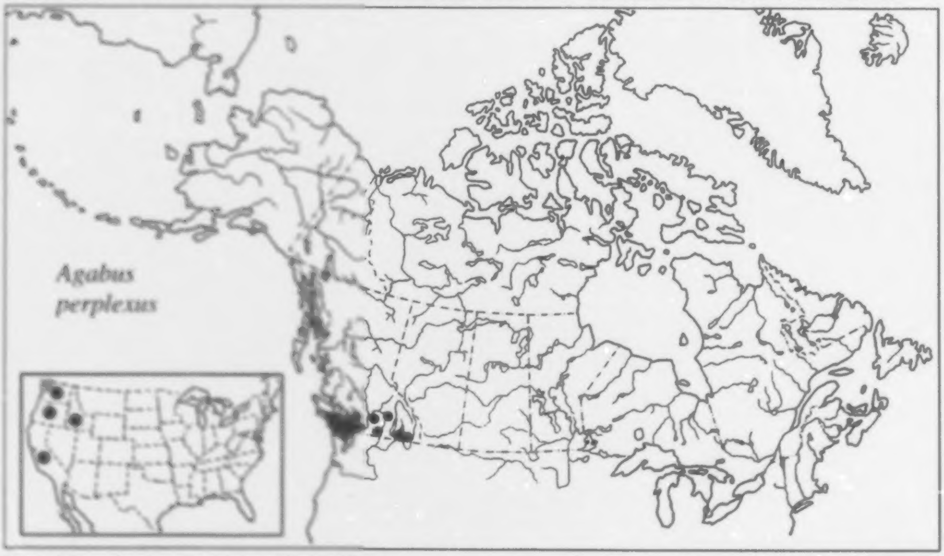
Elytron with meshes small, subequal in size but of varied shape, flat basomedially, slightly convex laterally and apically; basomedially lines most finely impressed, with small, often obscure punctures at intersections; many meshes with one or two small punctures. Metacoxal plate with lines well impressed, forming irregular meshes mesally, meshes distinctly elongated on outer half. Metafemur with elongate, oblique meshes but without lines deepened to form discrete strioles; with small, more or less evenly spaced punctures. Sternum 6 with sculpture coarser along hind margin and forming shallow irregular longitudinal grooves encompassing setiferous punctures, surface smoother medioapically.

Pronotum broad, lateral margin broadly and evenly arcuate, more or less continuous in curvature with lateral margin of elytron; posterolateral angle right angled to slightly acute but with apex narrowly rounded; lateral bead of moderate width, about three-quarters width of a medial antennomere; lateral margin, in lateral aspect, slightly and broadly arcuate, proepipleuron narrowly exposed below anterolateral angle. Prosternum tectiform in cross section, process less strongly convex and more evenly rounded, flattest basally, more convex apically; apex acute; lateral margin well developed basally but not inflated. Metasternal wing broad (Fig. 136A), width metacoxa: width of metasternal wing = 1.60 to 2.29. Hind legs slender, metafemur length: width = 3.17 to 3.44; metatibia length: width = 4.43 to 5.00. Metatibia with a complete row of moderate sized, distinctly separated punctures along posteroventral margin, ventral face with coarser punctures irregularly scattered along most of length. Length metatibial spur: length metatarsomere 1 = 0.82 to 0.94.

Male protarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.16 to 0.20 mm; protarsal ratio = 1.76: 1.64: 1.38: 1.12: 1; protarsomeres 1 to 3 bearing small, oval, more or less even sized adhesive setae. Protarsal claws subequal in length, similarly arcuate, anterior claw broader, slightly expanded ventrally and on some specimens forming a low, obtuse ventrobasal tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.47 to 0.54. Aedeagus (Fig. 137C, D) in lateral aspect strongly bent basally, apex in dorsal aspect with left margin sinuately narrowed apically.

Ecology. Specimens have been collected in southwestern British Columbia from the margins of springs and very small streams. These streams ran through rain-forest, cut over and urban parks. The beetles occur among rocks, gravel, leaf packs and debris along the stream margins and in small pools where the flow is slow or broken.

Distribution. Map 161. The range extends along the Pacific coast from southwestern British Columbia to southern California and inland in the Sierra Nevada Mountains.



Map 161. *Agabus perplexus* Sharp. Canadian and Alaskan collection localities and United States state records.

32. *Agabus seriatus* (Say 1823)

Figs. 136F; 137E – G; 138

Colymbetes seriatus Say 1823: 97. Type locality - Neotype from North Lebanon, New York (Leech 1942*b*: 126).

Selected References. Hilsenhoff 1993*c*: 189; Larson 1997*a*: 117 – 121; Larson 1997*b*: 510.

Description. Length = 6.9 to 9.5 mm; width = 3.7 to 4.9 mm; length: width = 1.74 to 2.13. Habitus as in Fig. 138, smallest and narrowest species of group but size and shape varying geographically.

Color black, many specimens shiny and some with a faint brassy reflection. Head with frontal spots conspicuous or not; antenna rufous but most specimens with antennomeres 3 to 11 slightly to distinctly infuscate apically; palpi rufous, apical palpomere of each palpus infuscate apically on most specimens. Pronotum with lateral and basal margins piceous. Abdominal sterna 3 to 6 with hind margin piceous, also lateral portions of sterna 3 to 5 piceous on some specimens. Legs dark rufous to piceous.

Elytron with meshes of irregular polygonal shape; lines shallowest basomedially but complete, lines more deeply impressed apically making meshes smaller and more convex; small punctures visible at intersections of shallow lines and on some specimens along finest, most shallowly impressed lines; meshes with small, sparse punctures, surface smooth and without microreticulation or fine reticulation present apically where meshes are coarser and somewhat granulate on many specimens.

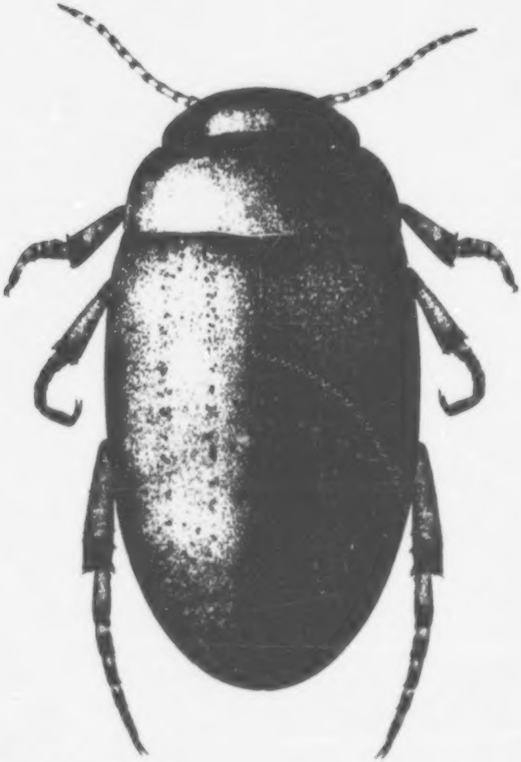


Fig. 138. *Agabus seriatus* habitus.

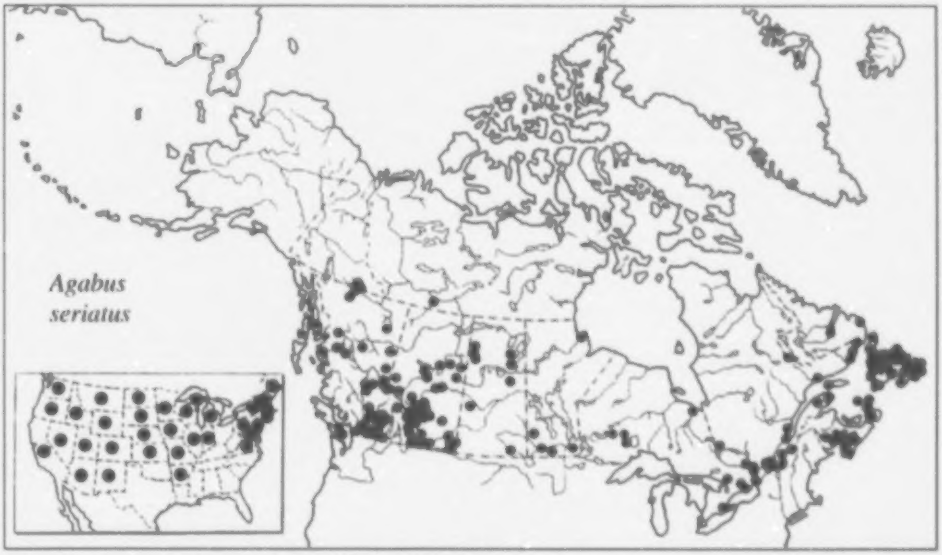
Pronotum with lateral margins broadly rounded anteriorly, almost parallel-sided toward base on many specimens; lateral bead moderately narrow, about one half as wide as a median antennomere; posterolateral angle slightly produced, right angled or slightly acute but narrowly rounded apically; posterior margin faintly bisinuate each side of middle; lateral margin in lateral aspect slightly and broadly arcuate, more so near posterolateral angle, proepipleuron triangularly visible below anterolateral angle. Prosternum with broad, medially rounded subtectiform convexity; prosternal process basally almost flat to slightly and evenly convex, smoothly convex apically; surface smooth and glabrous. Metasternal wing broad but width varying geographically, width metacoxa: width of metasternal wing = 1.64 to 3.87. Legs slender, metafemur length: width = 3.08 to 3.54; metatibia length: width = 4.42 to 5.52; metafemoral comb poorly developed; metatibia with more or less complete row of separated setiferous punctures along posteroventral margin, medioventral series of punctures well developed and extending onto apical half of metafemur. Length metatibial spur: length metatarsomere 1= 0.68 to 0.87.

Male protarsomeres 1 to 3 slightly dilated, with numerous small, similar sized adhesive scales beneath; anterior protarsal claw slightly longer and broader than posterior with a broad, low ventral tooth or expansion near base. Aedeagus (Fig. 137E, F) simple, apex bent slightly to right.

Comments. This species varies considerably in size, shape, microsculpture and width of the metasternal wing. However, because this variation is either clinal or discordant Larson (1997*a)* found no basis for recognizing infraspecific groups.

Ecology. These beetles occur in flowing water, usually in springs or near the source of spring-fed streams, as well as in small creeks and occasionally along the margins of small rivers. The beetles usually occur on mineral substrates such as clay, sand or gravel but may also be in clumps or mats of vegetation in or at the edge of flowing water. Beetles seldom occur in depositional areas or on silty or peaty substrates. All larvae and adults collected by Hilsenhoff (1993*c*) in Wisconsin were collected from lotic habitats, especially small, spring-fed creeks. The species has a wide range in mountainous areas of the western portions of the continent but in this region it is found mainly in lower-gradient, warmer streams. The species does not occur in cascades, very cold snow-field or glacier-melt water or in alpine sites. In Wisconsin, the predominant overwintering stage is the adult. Larvae develop slowly from late spring through the summer and teneral adults occur from midsummer into fall (Hilsenhoff 1993*c*).

Distribution. Map 162. *Agabus seriatus* is widely distributed in temperate parts of North America, from Newfoundland to southeastern Yukon Territory and south to Virginia, Missouri, New Mexico and California.



Map 162. *Agabus seriatus* (Say). Canadian and Alaskan collection localities and United States state records.

33. *Agabus pandurus* Leech 1942

Figs. 136C; 139A, B

Agabus pandurus Leech 1942*b*: 128 – 129. Type locality – Holotype - Eel River, Pepperwood, Humbolt Co., California.

Selected Reference. Larson 1997*a*: 121 – 123.

Description. Length = 8.7 to 10.4 mm; width = 4.7 to 5.6 mm; length: width = 1.75 to 1.91. A moderately large, broad species, similar to *A. brevicollis* but tending to be darker in color and more parallel-sided in shape, with coarser sculpture, broader metasternal wing, narrower metatibia and less modified male tarsal claws.

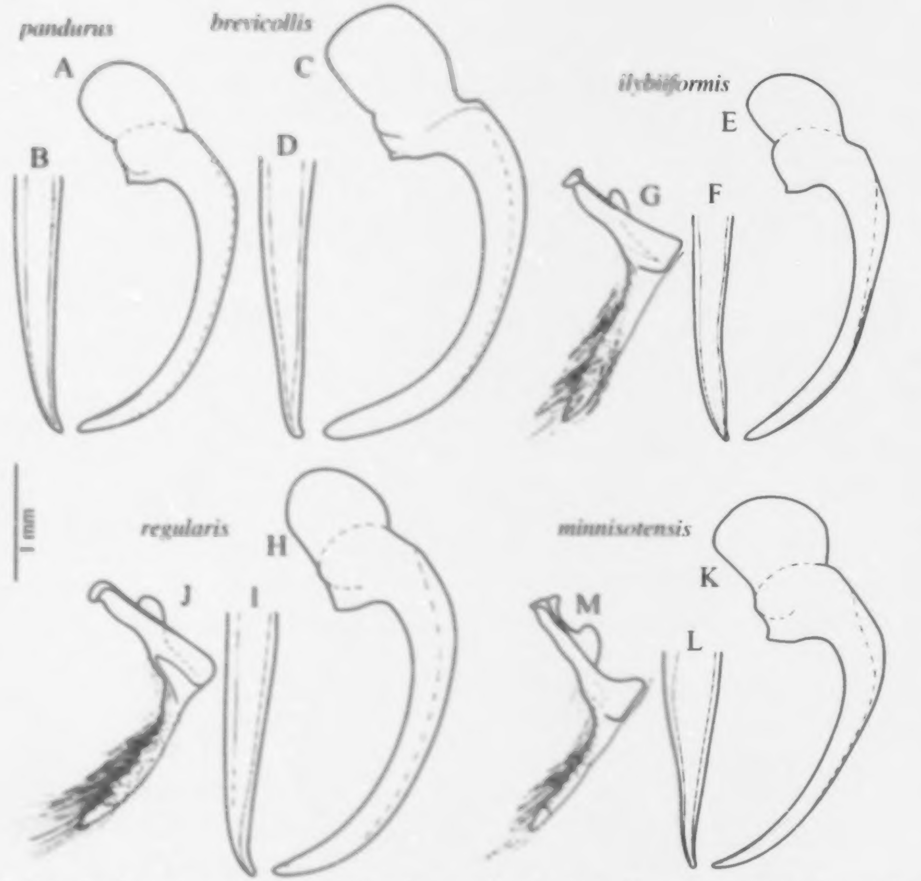


Fig. 139. *Agabus seriatus*-group, *brevicollis*-subgroup. A – B - *A. pandurus*. A - aedeagus, lateral. B - aedeagus apex, dorsal. C – D - *A. brevicollis*. C - aedeagus, lateral. D - aedeagus apex, dorsal. E – G - *A. ilybiiformis*. E - aedeagus, lateral. F - aedeagus apex, dorsal. G - paramere. H – J - *A. regularis*. H - aedeagus, lateral. I - aedeagus apex, dorsal. J - paramere. K – M - *A. minnesotensis*. K - aedeagus, lateral. L - aedeagus apex, dorsal. M - paramere.

Color piceous to black. Head piceous with anterior margin of clypeus, frons above antennae and a pair of usually vaguely defined frontal spots between eyes, rufous; antenna and palpi rufous, without infuscation. Pronotum with anterolateral angle and anterior portion of lateral margin narrowly mesad to bead, rufous. Elytron with an elongate sublateral pale spot posterad of middle but may be visible only when elytron is lifted; epipleuron rufous. Ventral surface and legs dark rufous to piceous.

Elytron medially with lines shallow and meshes more or less flat, lines deeper and meshes more convex or even granulate towards margins and apex, meshes of irregular shape and without definite orientation, of more or less similar size; punctures present at some intersections otherwise absent from lines, meshes medially with sparse micropunctures, not evident laterally; male without microreticulation; female with microreticulation mediolaterally and sublaterally although reticulation may be variously effaced. Metacoxal plate with coarse meshes of somewhat elongate shape; metacoxal plate with shallow transverse rugae. Sternum 6 coarsely sculptured mediolaterally, posterolateral punctures distinct or with a few longitudinal rugae along hind margin each side of middle.

Pronotum broad, lateral margins evenly arcuate; lateral bead well defined medially, narrower or obsolete on anterolateral angle; hind margin almost straight, slightly lobed medially and faintly concave laterally near narrowly rounded, broadly acute posterolateral angle; in lateral aspect lateral margin slightly arcuate on posterior half, epipleuron visible below anterolateral angle. Prosternal process lowly and evenly convex, surface with micropunctures and a few coarser setiferous punctures laterally, lateral bead narrow, broadest posterad to procoxae, narrow and continuous almost to apex; apex acuminate. Metasternal wings (Fig. 136C) narrow, width metacoxa: width of metasternal wing = 3.22 to 4.34. Hind legs slender, metafemur length: width = 2.57 to 3.30; metatibia length: width = 3.93 to 4.96; metafemur with relatively dense small punctures; metatibia with a complete row of punctures along posteroventral margin, punctures more or less confluent and forming submarginal groove; mesoventral face with punctures extending most of length. Length metatibial spur: length metatarsomere 1 = 0.89 to 1.04; apex of spur slightly curved.

Male protarsomeres relatively narrowly dilated, width protarsomere 1 = 0.18 to 0.22 mm; protarsal ratio = 1.70: 1.59: 1.34: 1.13: 1; protarsomeres 1 to 3 bearing dense small adhesive setae, with a few slightly larger setae along apical margins of protarsomeres 1 and 2; protarsal claws not modified on some specimens, on others with ventral margin slightly broadened basally as an anterior flange. Mesotarsomeres not elongated, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.48 to 0.57; mesotarsal claws similar or anterior slightly broader than posterior. Aedeagus (Fig. 139A, B) similar to that of *A. brevicollis* but slightly narrower apically and basal angulation more distinct.

Ecology. Most collection labels indicate specimens were collected from creeks or rivers.

Distribution. This species is known only from California, from Del Norte and Siskiyou Counties south to San Benito Co., and in the Sierra Nevada Mountains. Although the range of *A. brevicollis* lies within that of *A. pandurus*, there are no records of the species co-occurring in any site. The elevational distribution ranges from near sea-level to about 2000 m.

34. *Agabus roguus* Larson 1997

Agabus roguus Larson 1997*a*: 123 – 124. Type locality - Mussel Creek 4 mi. N. of Ophir, Curry Co., Oregon.

Selected Reference. Larson 1997*a*: 123 – 124.

Description. Length = 9.4 to 10.3 mm; width = 5.0 to 5.6 mm; length: width = 1.78 to 1.94. A large, black species very similar to *A. pandurus*, differing in the longitudinally stretched elytral sculpture of the female and in male protarsal characters.

Color piceous to black dorsally. Head with clypeus, frons above base of antennae and a pair of diffuse spots on frons between eyes, rufous; antennae and palpi rufous, without apical infuscation. Pronotum with anterolateral angle and lateral margin narrowly rufous. Elytron with a sublateral postmedial elongate pale spot; epipleuron rufous. Ventral surface and legs rufous to rufopiceous.

Elytron with sculpture sexually dimorphic. Male with meshes of irregular polygonal shape, lines finest basomedially, complete with punctures visible only at intersections, laterally and apically lines deeper, meshes more granular, meshes smooth or finely punctate basally, rugose or obsoletely reticulate apically. Female with lines finer, longitudinal and forming strongly longitudinally stretched meshes on basal half of disc, apically meshes polygonal; meshes with microreticulation well developed basally, somewhat effaced on granular apical meshes. Metacoxal plate with longitudinal meshes which tend to be somewhat broken by transverse rugae. Sternum 6 with lines deeply impressed.

Pronotum with lateral bead of moderate width, well delimited from disc except narrowing and becoming obsolete on anterolateral angle of many specimens; basal margin broadly rounded medially, faintly concave laterally, hind angle slightly produced and acute, narrowly rounded apically; lateral margin in lateral aspect broadly arcuate, more strongly so posteriorly, proepipleuron visible anteriorly. Prosternum medially broadly tectiform, prosternal process flatter, smoothly and evenly convex in cross-section, micropunctate with a few coarser setiferous punctures laterally, lateral bead of moderate width posterad to procoxae, narrowing apically but obsolete before acuminate apex. Metasternal wings narrow, width metacoxa: width of metasternal wing = 3.25 to 3.84; outer portion ligulate but its posterior margin more or less smoothly arcuate. Metafemur and metatibia slender, metafemur length: width = 2.87 to 3.09; metatibia length: width = 4.12 to 5.11; metafemur with ventral surface with small but distinct punctures; metatibia with posteroventral margin bearing a complete single row of more or less contiguous punctures, mesal face with coarse punctures along most of length; length metatibial spur: length metatarsomere 1 = 0.90 to 1.03, spur not distinctly curved apically.

Male protarsomeres 1 to 3 narrowly dilated but slightly more so than in related species, width of protarsomere 1 = 0.23 to 0.27 mm; protarsal ratio = 1.83: 1.66: 1.40: 1.13: 1; protarsomeres 1 to 3 ventrally with dense adhesive setae of more or less uniform size except slightly larger setae along apical margin of each protarsomere; protarsal claws dissimilar in shape, anterior longer than posterior and with a relatively well developed basoventral flange along anterior face. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.56; anterior mesotarsal claw distinctly broadened, more so than posterior. Sternum 6 with coarse, irregular longitudinal rugae along posterolateral margin. Aedeagus similar to that of *A. brevicollis* and *A. pandurus*.

Ecology. Specimens have been collected from creeks and rivers.

Distribution. The species is known only from Curry Co., Oregon.

35. *Agabus brevicollis* LeConte 1857

Figs. 136D; 139C, D

Agabus brevicollis LeConte 1857: 34. Type locality - Upper Sacramento River, California.

Selected references. Larson 1997*a*: 125 – 126.

Description. Length = 8.9 to 10.5 mm; width = 4.8 to 5.6 mm; length: width = 1.75 to 1.91. Body broad, broadly rounded laterally and widest slightly posteriad to middle; broadly convex dorsally.

Color rufopiceous to black. Head rufopiceous to piceous with anterior margin of clypeus, frons above base of antennae and a pair of poorly defined frontal spots on frons between eyes paler, rufous; ventral surface rufopiceous to piceous; antenna and palpi reddish, without infuscation. Pronotum piceous to black except anterolateral angle rufous, lateral bead and narrow adjacent margin of disc translucent, rufous. Elytra piceous to black, with an elongate sublateral pale spot posteriad of middle. Ventral surface and legs dark rufous to piceous.

Elytron basomedially with lines fine, some interrupted forming enlarged joined meshes, shallowest lines with evident small punctures; laterally lines deeper and complete, punctures inconspicuous or visible only at intersections; meshes smooth medially with sparse, small punctures, males and some females with elytron lacking microreticulation, most females with well developed microreticulation on meshes on sublateral portions of disc, microreticulation obsolete near lateral margin. Metacoxal plate with coarse, slightly to distinctly elongate meshes; sparsely and shallowly transversely rugose. Sternum 6 of male with hind margin strongly longitudinally rugose each side of middle; female with rugae fewer and shallower.

Pronotum with lateral bead of moderate width, low but clearly delimited from disc except on anterolateral angle of some specimens; posterolateral angle slightly produced, acute; lateral margin in lateral aspect slightly arcuate, most so posteriorly, epipleuron shortly visible below anterolateral angle. Prosternum medially broadly tectiform, prosternal process flatter, broadly and smoothly convex, surface smooth except micropunctate and a few coarse setiferous punctures laterally, apex acuminate, lateral bead narrow, extending almost to apex. Metasternal wing (Fig. 136D) narrow, posterior margin of wing clearly sinuate laterally; width metacoxa: width of metasternal wing = 3.72 to 4.46. Hind legs moderately robust, metafemur length: width = 2.36 to 3.05; metatibia length: width = 3.47 to 4.20; metafemur with ventral surface with small but conspicuous punctures. Metatibia with a complete, single row of more or less contiguous punctures along hind margin; ventral face with medial series of punctures extending most of length. Length metatibial spur: length metatarsomere 1 = 0.96 to 1.11, apex of spur with a short but distinct curve on most specimens. Metatarsomere 1 with one to several externoventral setae.

Male with pro- and mesotarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.18 to 0.23 mm; protarsal ratio = 1.71: 1.61: 1.38: 1.18: 1; protarsomeres 1 to 3 ventrally with dense, small adhesive setae of more or less uniform size except a few slightly larger setae along posterior margin of each tarsomere; protarsal claws with anterior claw slightly longer and thicker than posterior, with anteroventral margin expanded basally. Mesotarsus not elongate, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.53; anterior mesotarsal claw slightly longer and broader basally than posterior. Aedeagus (Fig. 139C, D) similar to that of *A. pandurus* and *A. roguus* but slightly broader in lateral aspect.

Ecology. Like other members of the group, this is a flowing water species occurring in small gravelly or rocky streams.

Distribution. This species is of very localized distribution, known from the vicinity of San Francisco Bay and south along the coast to Carmel, California.

36. *Agabus ilybiiformis* (Zimmermann 1928)

Fig. 136B, 139E – G

Gaurodytes ilybiiformis Zimmermann 1928: 176 – 177. Type locality - Santa Clara, California.

Selected references. Larson 1997*a*: 126 – 127.

Description. Length = 8.4 to 9.3 mm; width = 4.7 to 5.3; length: width = 1.75 to 1.91. Body smoothly oval in outline, relatively strongly convex dorsally

Color rufous to rufopiceous, not black. Head pale rufous anteriorly, darker rufous medially and posteriorly, frontal spots obscure; antennae and palpi rufous, without infuscation. Pronotum with anterolateral angle and lateral margin rufous, gradually darkened medially on disc; elytra rufopiceous to piceous, paler near shoulder, disc with a small oval sublateral spot posterad to middle, spot more ovate than in related species; epipleuron rufous. Ventral surface and legs rufous to piceous, metatrochanter and also metafemur on some specimens conspicuously paler than darker outer portions of hind legs.

Elytron with lines deeply impressed over disc, sculpture coarse; lines without evident punctures; meshes with very fine, sparse punctures but these obscured over most of disc by microreticulation; microreticulation present but on many specimens more or less effaced medially and adjacent to lateral margin. Metacoxal plate with deeply impressed longitudinal lines not forming coherent meshes or meshes very elongate; distinct transverse rugae present; meshes smooth or with partly effaced microreticulation. Sternum 6 with coarse sculpture posterolaterally but without distinct longitudinal rugae.

Pronotum with lateral bead of moderate width, well defined except narrowed and obsolete on anterolateral angle of many specimens; posterolateral angle produced, acute; basal margin perceptibly bisinuate each side of middle; lateral margin in lateral aspect very slightly arcuate, epipleuron only narrowly evident below anterolateral angle. Prosternum tectiform in cross-section, medial convexity continued onto prosternal process which is angularly convex or more or less tectiform in cross-section; process with lateral bead narrow, extending almost to apex which is strongly acuminate. Metasternal wing (Fig. 136B) moderately narrow, width metacoxa: width of metasternal wing = 3.22 to 3.89, posterior margin more or less evenly arcuate. Hind legs relatively broad, metafemur length: width = 2.28 to 3.05, metatibia length: width = 3.43 to 4.15; metafemur and metatrochanter with punctation strong, punctures each bearing a short seta best seen in oblique aspect and longest distally. Metafemur with a row of closely set, more or less confluent punctures along hind margin; mesal face with coarse punctures scattered along entire length. Length metatibial: length metatarsomere 1 = 1.04 to 1.16.

Male protarsomeres 1 to 3 moderately dilated, width protarsomere 1 = 0.18 to 0.22 mm; protarsal ratio = 2.02: 1.85: 1.49: 1.18: 1; protarsomeres 1 to 3 ventrally with small adhesive setae, scales of setae of more or less uniform size except those on apex of tarsomeres 2 and 3 somewhat larger; anterior protarsal claw slightly longer than posterior, its ventral margin basally with a small ventral flange behind which is a scooped-out area. Mesotarsus not elongated, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.44 to 0.50; mesotarsal claws similar in shape. Male genitalia with aedeagus (Fig. 139E, F) relatively narrow in lateral aspect.

Ecology. This species occurs in slower water at the margins of streams.

Distribution. *Agabus ilybiiformis* occurs along the Pacific Coast from extreme southwestern Oregon to San Diego Co., California, and inland in the Sierra Nevada Mountains.

37. *Agabus regularis* (LeConte 1852)

Figs. 136E; 139H – J

Ilybius regularis LeConte 1852: 203. Type locality - California.

Selected Reference. Larson 1997*a*: 128 – 129.

Description. Length = 9.2 to 11.3 mm; width = 5.2 to 6.1 mm; length: width = 1.73 to 1.87. A large, broadly oval, strongly convex species, resembling some species of *Ilybius* in habitus.

Color dark rufous to piceous, seldom if ever truly black, most specimens with a more or less brassy sheen. Head dark rufous to piceous with clypeus, anterior and lateral portions of frons and frontal spots paler, rufous; antenna and palpi entirely rufous, without infuscation. Pronotum with lateral margin broadly rufous, gradually darkened sublaterally onto disc. Elytron piceous, rufous to rufopiceous laterally, with a small oval sublateral spot posterad of middle but spot may be visible only when elytron is lifted; epipleuron rufous. Ventral surface largely rufous, most specimens with metasternum, metacoxal plates and abdominal sterna somewhat darkened, rufopiceous. Legs rufous to rufopiceous.

Elytron medially with lines of sculpture shallow and more or less interrupted to form meshes of irregular sinusoidal shapes, laterally and apically lines deeper and meshes of more regular size but of varied shape; shallow lines densely punctate medially, deeper lines without evident punctation; meshes finely and sparsely punctate, best developed medially; meshes smooth medially, laterally and apically with variously effaced fine reticulation. Metasternum with reticulation more or less effaced, minutely punctate. Metacoxal plate with lines forming an open network of longitudinal meshes. Sternum 6 with coarse irregular meshes, with at most a few faint longitudinal rugae along hind margin.

Pronotum with lateral bead of moderate width, slightly elevated from disc but on many specimens becoming obsolete on anterior and posterior angles; lateral margin slightly arcuate, more or less evenly widening from front angles to base and continuous in curvature with lateral margin of elytron; posterolateral angle slightly produced, acute; basal margin smoothly arcuate except slightly concave near each lateral angle; in lateral aspect lateral margin hiding proepipleuron throughout its length, lateral margin more or less straight or slightly deflected downwards at posterolateral angle. Prosternum strongly convex medially, tectiform but with medial angle narrowly rounded; prosternal process smoothly convex in cross-section, apex sharply pointed; lateral bead narrow. Metasternum (Fig. 136E) with lateral wing narrow, laterad of mesocoxae strongly narrowed and ligulate; width metacoxa: width of metasternal wing = 4.26 to 5.33. Metafemur broad, metafemur length: width = 2.32 to 2.60; lacking strioles but it and metatrochanter with sparse, small but distinct punctures. Metatibia broad, metatibia length: width = 2.60 to 3.21, posteroventral margin with small, more or less contiguous punctures along entire length, punctures numerous on basal half and series two to several punctures wide; mesal face with well separated punctures scattered along entire length; metatibial spurs long, length spur : length metatarsomere 1 = 1.28 to 1.59. Metatarsomeres short and broad, very broadly and slightly lobed on posteroventral angle, with only a single ventrolateral row of stiff setae.

Male protarsus slightly dilated, protarsal ratio = 1.87: 1.68: 1.45: 1.18: 1; tarsomeres 1 to 3 ventrally with small adhesive setae as well as a transverse row or much larger setae on apical margin of each tarsomere; protarsal claws similar in length and curvature but anterior claw slightly widened ventrally. Mesotarsus with tarsomere 5 short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.38. Aedeagus (Fig. 139H, I) in lateral view with shaft of moderate width and subparallel over length.

Ecology. This species occurs in streams.

Distribution. This species occurs only in California and Baja California.

38. *Agabus minnesotensis* Wallis 1933

Fig. 139K – M

Agabus minnesotensis Wallis 1933*b*: 268. Type locality - given as: Hennepin Co., Minnesota, but specimen certainly mislabeled.

Selected Reference. Larson 1997*a*: 129 – 131.

Description. Length = 9.6 to 11.1 mm; width = 5.2 to 6.0 mm; length: width = 1.78 to 1.91. Similar to *A. regularis* but on average not so convex dorsally and slightly darker in color.

Color dark piceous to black. Head with anterior margin of clypeus, frons above antenna and frontal spots between eyes, rufous; antenna and palpi rufous, without infuscation. Pronotum with lateral bead and some specimens with disc narrowly mesad to bead, rufous to rufopiceous. Elytron rufous with a narrow, elongate sublateral pale spot posterad to middle but spot may be visible only when elytron is lifted. Ventral surface rufous to piceous. Legs dark rufous to piceous.

Elytron medially densely and more or less confusedly punctate, laterally and apically lines of sculpture better defined and deeper and punctures situated mainly in lines or disappearing in deeper lines towards edges of elytron; meshes smooth, microreticulation absent or very reduced. Metasternum smooth medially with dense fine punctation. Metacoxal plates with lines shallow, dense, forming meshes of very irregular shape and not conspicuously elongated. Sternum 6 with lines relatively shallow, more or less transverse and not forming coherent mesh-work; with a few longitudinal rugae along hind margin on each side of middle.

Pronotum with lateral margins evenly and broadly arcuate, more or less continuous in curvature with lateral margin of elytron; hind margin broadly rounded, slightly convex near lateral angle; posterolateral angle slightly produced, acute; lateral bead evident but weakly delimited from disc; lateral margin in lateral aspect slightly arcuate, epipleuron visible below anterolateral angle of many specimens. Prosternum longitudinally tectiform medially; prosternal process less strongly convex, convexity subangulate but rounded medially, apex acuminate; lateral bead narrow. Metasternal wing narrow, width metacoxa: width of metasternal wing = 3.70 to 4.58, wing laterad of mesocoxae very narrow and ligulate. Metafemur stout, metafemur length: width = 2.57, without strioles but with sparse fine punctures. Metatibia broad, metatibia length: width = 2.59 to 3.04, with a complete row of punctures along posteroventral margin, punctures forming a single row and well separated from one another; mesoventral face with scattered punctures along most of length, punctures relatively large and well separated; metatibial spurs large, length spur: length metatarsomere 1 = 1.15 to 1.46. Metatarsomere 1 with a single setae ventral to lateral row of natatorial setae; natatorial setae present on outer margin of metatarsomeres 1 to 3.

Male protarsomeres 1 to 3 narrowly dilated, protarsal ratio = 1.85: 1.68: 1.50: 1.19: 1; protarsomeres 1 to 3 ventrally with small, elongate scales, apical scales of each tarsomere not distinctly enlarged; protarsal claws subequal in length, similarly arcuate, anterior claw slightly broadened ventrally. Mesotarsomere 5 not elongated, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.37 to 0.43. Male genitalia with aedeagus (Fig. 139K, L) narrower and less arcuate apically than that of *A. regularis*.

Ecology. These beetles occur in small, clear mountain streams, usually 2nd and 3rd order, where they occur among gravel, rocks and leaf packs along the margins of pools and eddies. Specimens are generally in portions of streams with permanent flow, in forested mountain areas or just at the point where these streams emerge onto desert lowlands. Teneral specimens have been collected in April and May.

Distribution. The species occurs from southern Colorado, Utah and Nevada to central Mexico.

Agabus cordatus-group
Figs. 140; 141

Anisomera LeConte 1853*b*: 226. Type species - *Anisomera cordata* LeConte 1853*b*, by monotypy.

Diagnosis. Medium sized species, length = 8.0 to 10.7 mm; body elongate and parallel-sided medially, pronotum with lateral margins subparallel to constricted basally and distinctly narrower than elytra across shoulders, body outline strongly discontinuous. Color reddish brown to black, elytron without a sublateral spot near middle. Sculpture with meshes of small to moderate size and irregular shape; lines, where shallowly impressed, with punctures at intersections and along lines (best seen medially on pronotum). Metafemur without strioles but indistinctly to strongly punctate. Clypeal bead broadly broken medially. Frontal punctures present. Pronotum (Fig. 140A – E) with lateral margin various, broadly rounded laterally, subparallel basally or constricted and hind angle acute; anterior bead obsolete medially; anterior submarginal row of punctures complete; lateral bead narrow to moderate in width. Elytron in lateral aspect with epipleuron visible to humeral angle. Prosternum and its process basally in more or less same plane, apically process deflected upwards; process short and broad with apex sharply to bluntly pointed, smoothly convex medially; lateral bead not inflated. Metasternum with anteromedial impression short and shallow to sharply incised and reaching level of hind margin of mesocoxae; metasternal wing of moderate width to broad. Legs slender. Metafemur with setae of posteroapical angle forming a linear comb or irregularly arranged and not forming a definite comb. Metatibia with a complete row

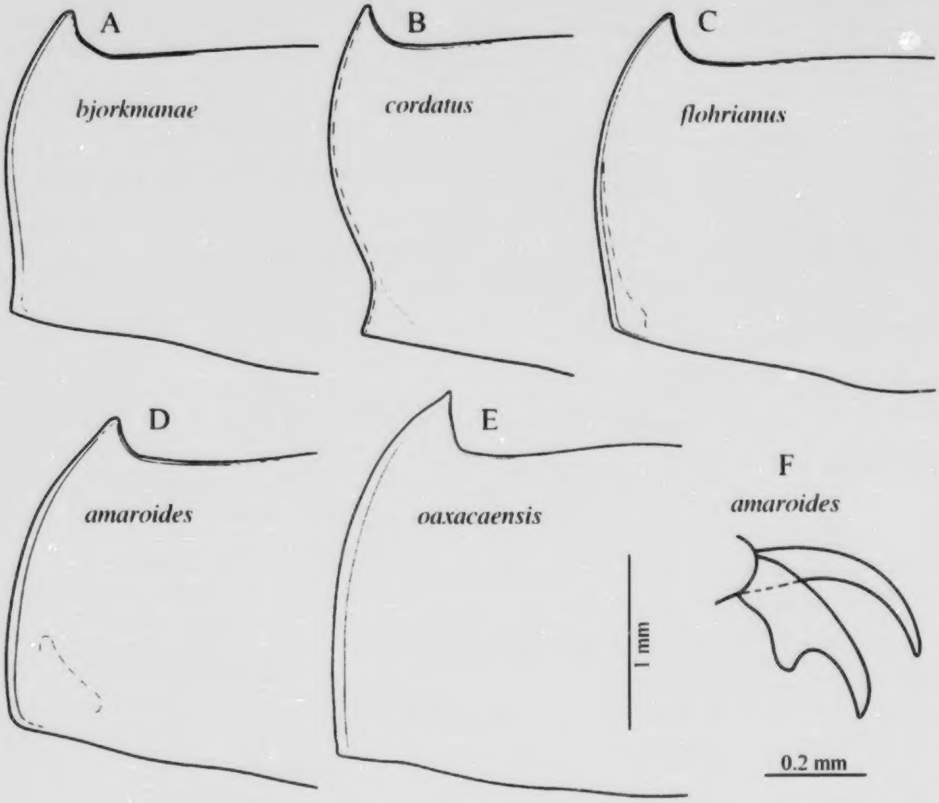


Fig. 140. *Agabus cordatus*-group. A – E - pronotum, left half. A - *A. bjorkmanae*. B - *A. cordatus*. C - *A. flohrianus*. D - *A. amaroides*. E. *A. oaxacaensis*. F - male protarsus anterior, *A. amaroides*.

of punctures along posteroventral margin, mesal face with irregular series of punctures along most of length; longer metatibial spur shorter than metatarsomere 1. Metatarsomeres without dorsal setiferous punctures. Male protarsomeres 1 to 3 distinctly enlarged, with dense small oval adhesive setae beneath; protarsal claws unmodified or anterior claw with a ventral tooth (Fig. 140F). Mesotarsus not elongated. Parameres (Fig. 141C, F, J) stylate, basal sclerite elongate and narrow; aedeagus slender, without a subapical spine, in dorsal aspect apex curved to right. Female gonocoxae (Fig. 141M) elongate, laterally flattened and densely setose apically, without a lateral ridge.

Comments. Members of this group are lotic, generally occurring under cover along the margins of small streams and rivers. The sister group is probably the *seriatus*-group with the *cordatus*-group showing a more extreme development of the trends shown by *A. seriatus*, that is narrowing of body and pronotum and development of slenderer legs.

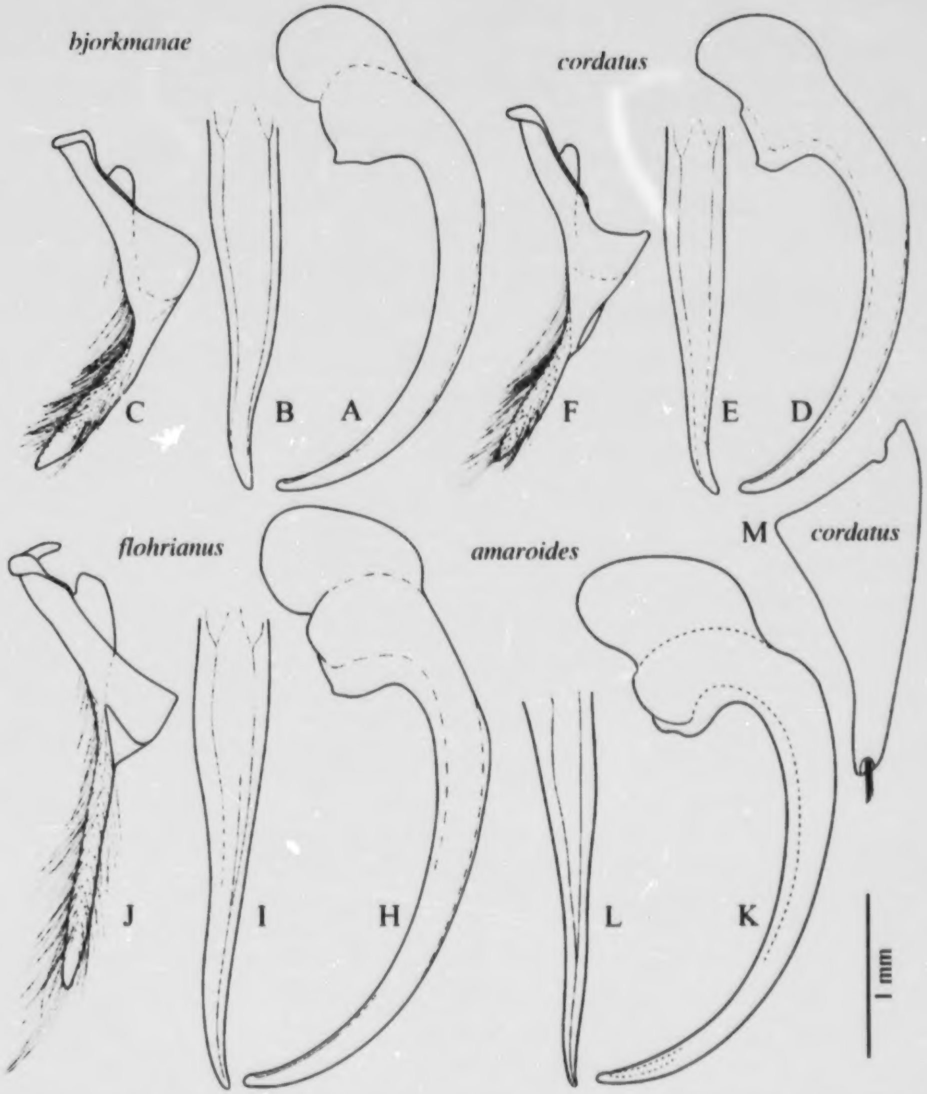

bjorkmanae
cordatus
C
B
A
F
E
D
M
cordatus
flohrianus
amaroides
J
I
H
L
K
1 mm

Fig. 141. *Agabus cordatus*-group. A – C - *A. bjorkmanae*. A - aedeagus, lateral. B- aedeagus apex, dorsal. C - paramere. D – F - *A. cordatus*. D - aedeagus, lateral. E - aedeagus apex, dorsal. F - paramere. H – J - *A. flohrianus*. H - aedeagus, lateral. I - aedeagus apex, dorsal. J - paramere. K – L - *A. amaroides*. K - aedeagus, lateral. L - aedeagus apex, dorsal. M - female gonocoxa, *A. cordatus*.

39. *Agabus bjorkmanae* Hatch 1939

Figs. 140A; 141A – C

Anisomera recta LeConte 1869: 374. Type locality - Vancouver Island, British Columbia. Type – MCZC, female, no. 6045, examined. [Not Babington 1840].

Agabus bjorkmanae Hatch 1939: 104. New name for *A. rectus* LeConte.

Selected Reference. Larson 1975: 336 – 337.

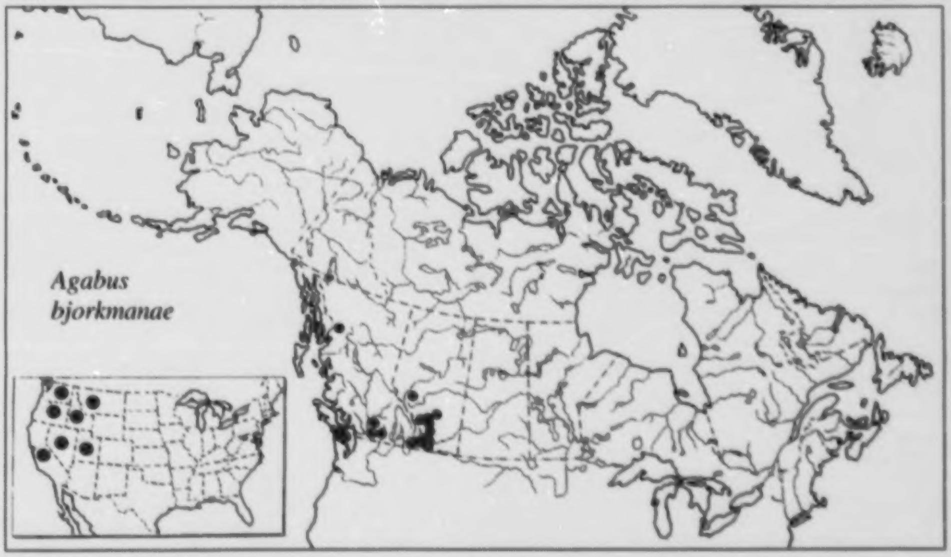
Description. Length = 8.8 to 10.7 mm; width = 4.5 to 5.1 mm; length: width = 1.90 to 2.15. Body subparallel, distinctly discontinuous in outline.

Body rufopiceous to black. Palpi and antenna rufous, at least apical antennomere infuscate. Legs rufous to piceous.

Elytron coarsely reticulate, lines deeply impressed forming small, somewhat rounded, granular meshes of irregular size and shape.

Pronotum (Fig. 140A) with sides constricted in basal half, distinctly sinuate before right angled to acute posterolateral angle; lateral bead narrow, well defined medially but indistinctly delimited on anterolateral angle and at base; in lateral aspect lateral margin strongly curved downwards on posterolateral angle, proepipleuron visible for its entire length. Prosternal process broadly pointed apically, smoothly convex in cross-section. Metasternum with anteromedial impression shallow, not or barely attaining level of hind margin of mesocoxae; metasternal wing broad, width of metacoxa: width of metasternal wing = 1.95 to 2.44. Metafemur with group of irregularly placed setae on posteroapical angle but setae not forming a linear comb; metatibia with a complete row of separated punctures along posteroventral margin; mesal face with series of punctures extending almost to apex; metafemur length: width = 3.63 to 3.89; metatibia length: width = 3.55 to 3.94; metatibial spurs short, length of longest spur: length metatarsomere 1 = 0.53 to 0.67.

Male protarsomeres 1 to 3 distinctly enlarged, width protarsomere 1 = 0.23 to 0.26 mm, protarsal ratio = 2.29: 2.05: 1.57: 1.12: 1; protarsomeres 1 to 3with dense ventral adhesive setae; protarsal claws subequal in length, similar in shape. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.54. Sternum 6 with coarse, irregular sculpture medially. Aedeagus (Fig. 141A, B) in dorsal aspect with apex twisted slightly to right; in lateral aspect evenly tapered to apex.



Map 163. *Agabus bjorkmanae* Hatch. Canadian and Alaskan collection localities and United States state records.

Ecology. The species is lotic. Specimens occur under cover such as rocks or logs along the margins of clear mountain streams. They are generally in larger streams, 2nd order or larger, where flows are strong enough to maintain relatively clear mineral substrates. Some specimens have been collected from cold clear mountain lakes, generally along wave-washed shorelines or near inlet streams. Although found in mountainous regions they usually occur in the lower subalpine zone, no specimens have been collected from alpine habitats.

Distribution. Map 163. The range extends from western Alberta and northern British Columbia to the northern edge of the Great Basin and northern California. South of this, the species is replaced by *A. cordatus* LeConte.

40. *Agabus cordatus* (LeConte 1853)

Fig. 140B, 141D – F, M

Anisomera cordata LeConte 1853*b*: 226. Type locality - Santa Fe, New Mexico. Type - MCZC, female, no. 6044, examined.

Selected References. Fall 1922: 9; Anderson 1962: 68.

Description. Length = 8.5 to 10.0 mm; width = 4.0 to 4.8 mm; length: width = 2.03 to 2.18. Body subparallel, strongly discontinuous in outline.

Body reddish brown to rufopiceous. Palpi and antennae rufous, most specimens with apex of apical antennomere infuscate. Legs rufous to rufopiceous.

Elytron with small, irregular meshes, lines more deeply impressed apically and forming more granular meshes of irregular size and shape.

Pronotum (Fig. 140B) with sides strongly constricted in basal half, distinctly sinuate before right angled to acute posterolateral angle; lateral bead very narrow, well defined medially but indistinctly delimited at base; in lateral aspect lateral margin strongly curved downwards on posterolateral angle, proepipleuron visible for its entire length. Prosternal process short, bluntly pointed, smoothly convex in cross-section. Metasternum with anteromedial impression shallow, not attaining level of hind margin of mesocoxae; metasternal wing broad, width of metacoxa: width of metasternal wing = 2.16 to 3.04. Metafemur with group of irregularly placed setae on posteroapical angle but setae not forming a linear comb; metatibia with a complete row of separated punctures along posteroventral margin; mesal face with series of punctures extending almost to apex; metafemur length: width = 3.58 to 3.89; metatibia length: width = 3.37 to 3.95; metatibial spurs short, length of longest spur: length metatarsomere 1 = 0.48 to 0.68.

Male protarsomeres 1 to 3 distinctly enlarged, width protarsomere 1 = 0.23 to 0.27 mm, protarsal ratio = 2.12: 1.94: 1.56: 1.14: 1; protarsomeres 1 to 3 each with dense ventral adhesive setae; protarsal claws subequal in length, similar in shape. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.48 to 0.59. Sternum 6 with irregular longitudinal rugae along hind margin. Aedeagus (Fig. 141D, E) in dorsal aspect with apex twisted slightly to right; in lateral aspect evenly tapered to apex.

Ecology. The beetles live amongst rocks and gravel at the margin of fast-flowing, clear streams.

Distribution. The range of this species lies south of that of that of *A. bjorkmanae* and includes the Great Basin region, western Colorado, New Mexico and Arizona.

41. *Agabus flohrianus* Sharp 1887

Figs. 140C; 141H – J

Agabus flohrianus Sharp 1887: 756. Type locality - Amecameca, Morelos, Mexico. Type - BMNH, male, examined.

Selected Reference. Blackwelder 1944: 78.

Description. Length = 8.9 to 9.9 mm; width = 4.3 to 4.7 mm; length: width = 1.98 to 2.13.

Head and pronotum piceous to black, elytra more rufescent. Palpi and antennae rufous, apex of antenna lightly infuscate. Legs rufous to rufopiceous.

Elytron rather shiny, lines finely impressed basally, deeper apically but not forming granular meshes, meshes of irregular polygonal shape and size.

Pronotum (Fig. 140C) with sides more or less evenly constricted in basal half, not to faintly sinuate before more or less obtuse posterolateral angle; lateral bead narrow; in lateral aspect lateral margin strongly curved downwards on posterolateral angle, proepipleuron visible for its entire length. Prosternal process very short and bluntly pointed apically, smoothly convex in cross-section. Metasternum with anteromedial impression shallow, short and not attaining level of hind margin of mesocoxae; metasternal wing broad, width of metacoxa: width of metasternal wing = 2.25 to 2.47. Metafemur with group of irregularly placed setae on posteroapical angle but setae not forming a linear comb; metatibia with a complete row of separated punctures along posteroventral margin; mesal face with series of punctures extending almost to apex; metafemur length: width = 3.22 to 3.46; metatibia length: width = 3.17 to 3.42; metatibial spurs short, length of longest spur: length metatarsomere 1 = 0.57 to 0.67.

Male protarsomeres 1 to 3 distinctly enlarged, width protarsomere 1 = 0.24 to 0.27 mm, protarsal ratio = 2.21: 1.97: 1.61: 1.24: 1; protarsomeres 1 to 3 each with dense ventral adhesive setae; protarsal claws subequal in length, similar in shape. Length mesotarsomere 5: length of mesotarsomeres 1 to 4 = 0.58 to 0.60. Sternum 6 with irregular longitudinal rugae along hind margin. Aedeagus (Fig. 141H, I) in dorsal aspect with apex twisted slightly to right; in lateral aspect evenly tapered to apex.

Ecology. The habitat has not been recorded.

Distribution. The species is known only from Mexico.

42. *Agabus amaroides* Sharp 1882

Figs. 140D, F; 141K, L

Agabus amaroides Sharp 1882*b*: 33. Type locality - Las Vigas, Mexico. Type - BMNH, male, examined.

Selected Reference. Blackwelder 1944: 78.

Description. Length = 8.2 to 9.6 mm; width = 4.1 to 4.7 mm; length: width = 1.95 to 2.04.

Body rufopiceous to black, elytron of most specimens slightly paler than forebody. Palpi and antennae rufous, most specimens with apices of outer antennomeres infuscate. Legs dark rufous to piceous.

Sculpture sexually dimorphic. Male elytron basally with fine lines forming small, irregular, polygonal meshes, lines deeper apically and meshes more granular. Female with entire elytron with small, convex, granular meshes.

Pronotum (Fig. 140D) with sides subparallel in basal half, narrower across base than elytra across humeral angles; posterolateral angle about right angled to slightly obtuse; lateral bead well defined, moderately narrow except laterally flattened and narrower on anterolateral angle; in lateral aspect lateral margin slightly curved downwards on posterolateral angle and upwards on anterolateral angle, proepipleuron visible along anterior half only. Prosternal process sharply pointed apically, smoothly convex in cross-section. Metasternum with anteromedial impression narrow, attaining level of hind margin of mesocoxae; metasternal wing broad, width of metacoxa: width of metasternal wing = 2.26 to 2.61. Metafemur with setae on posteroapical angle forming a linear comb; metatibia with a complete row of separated punctures along posteroventral margin; mesal face with series of punctures extending almost to apex; metafemur relatively broad, length: width = 2.77 to 3.08; metatibia length: width = 2.55 to 3.11; metatibial spurs relatively long, length of longest spur: length metatarsomere 1 = 0.73 to 0.81.

Male protarsomeres distinctly enlarged, width protarsomere 1 = 0.25 to 0.27 mm, protarsal ratio = 2.20: 1.91: 1.48: 1.17: 1; protarsomeres 1 to 3 each with dense ventral adhesive setae; protarsal claws (Fig. 140F) subequal in length, anterior claw with a strong ventral tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.57 to 0.63. Sternum 6 with irregular longitudinal rugae on posterolateral margins, smoother medially. Aedeagus (Fig. 141K, L) in dorsal aspect with apex twisted slightly to right; in lateral aspect evenly tapered to apex.

Ecology. The habitat is not known, but like other members of the group the species is probably lotic.

Distribution. Specimens have been examined from Veracruz, Mexico (10 mi s Las Vigas, 11, CASC; Las Vigas, 1, J. Zimmerman Collection).

43. *Agabus oaxacaensis* Larson, new species

Fig. 140E

HOLOTYPE. Female labelled: Mexico, Oaxaca, Llano de las Flores, 15 m N of Ixtlan, I.13.72, J.R. Zimmerman. Deposited in USNM.

PARATYPE. Female with same collection data as holotype. Deposited in USNM.

Description. (Measurements on 2 females). Length = 9.6, 9.8 mm; width = 4.9, 5.0 mm; length: width = 1.94, 1.97.

Body piceous. Palpi and antennae rufous, infuscate apically. Legs rufopiceous to piceous.

Elytron with meshes small, somewhat rounded basomedially, smaller and granular laterally and apically, with a tendency for longitudinal stretching or arrangement of meshes.

Pronotum (Fig. 140E) with sides subparallel in basal half, posterolateral angle slightly produced and acute; lateral bead relatively broad, not or only slightly narrowed anteriorly; in lateral aspect lateral margin evenly curved throughout its length, epipleuron visible only along anterior half of length. Prosternal process elongate and acutely pointed apically, smoothly convex in cross-section. Metasternum with anteromedial impression attaining level of hind margin of mesocoxae; metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.92 and 4.60. Metafemur with setae of posteroapical angle forming a linear comb; metatibia with a complete row of separated punctures along posteroventral margin; mesal face with series of punctures extending almost to apex; metafemur length: width = 2.70, 2.82; metatibia length: width = 2.65, 2.73; metatibial spurs moderate, length of longest spur: length metatarsomere 1 = 0.89.

Male not seen.

Etymology. The name is based on name of the Mexican state in which the type specimens were collected.

Comments. The two type specimens are very similar to female specimens of *A. amaroides*. However they have been treated as a separate species because of their narrow metasternal wings. Also there are differences in the shape of the pronotum and in the elytral sculpture.

Ecology. The habitat is unknown.

Distribution. The species is known only from the type locality.

Agabus adpressus-group

Fig. 142

Dichodytes Thomson 1886: x. Type species - *Gaurodytes angusticollis* J. Sahlberg (= *Agabus adpressus* Aubé), by original designation.

Diagnosis. Small species, length = 6.3 to 7.4 mm. Body outline discontinuous in dorsal aspect. Clypeal bead complete or at most with a few narrow, irregular breaks near middle. Frontal punctures absent. Pronotum with anterior bead obsolete medially; anterior row of submarginal punctures complete or narrowly broken medially; lateral bead broad; proepipleuron broadly exposed in lateral aspect. Prosternal process with lateral bead not inflated; process elongate. Aedeagus slender, without a subapical spine; straight in dorsal aspect. Gonocoxa laterally compressed, without a lateral ridge.

Comments. The single Nearctic species of this groups is superficially similar to some members of the *A. opacus*-group. However it differs in having the clypealbead complete, the prosternal process more elongate and the female gonocoxae laterally compressed and lacking a lateral ridge.

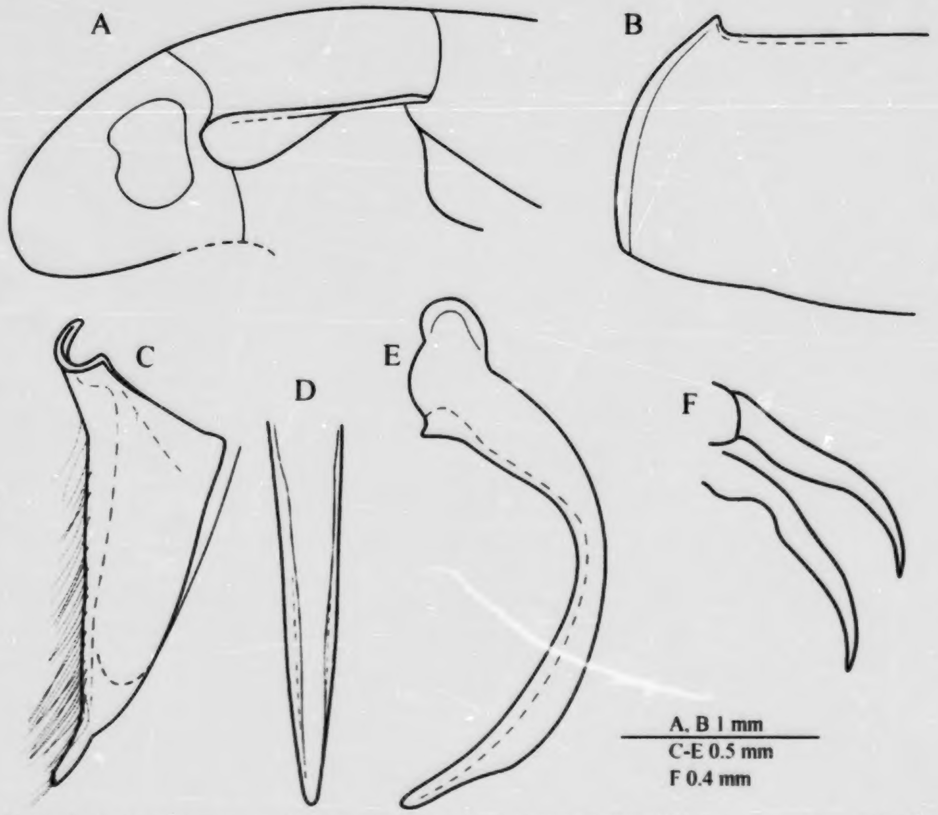


Fig. 142. *Agabus adpressus*. A. - pronotum, lateral. B- pronotum, dorsal. C - paramere. D - aedeagus, dorsal. E - aedeagus, lateral. F - male protarsal claws, anterior.

44. *Agabus adpressus* Aubé 1837

Fig. 142

Agabus adpressus Aubé 1837: 169. Type locality - "Dauria".

Agabus solus Leech 1949: 248 - 250. Type locality - Beaver Creek, Alaska. Type - CASC, male, no. 6155, examined.

Selected References. Leech 1949: 248 (as *A. solus* Leech); Young 1960*b*: 275, 277 (as *A. solus*); Larson and Nilsson 1985: 120; Nilsson and Holmen 1995: 102 – 103; Larson 1997*b*: 507.

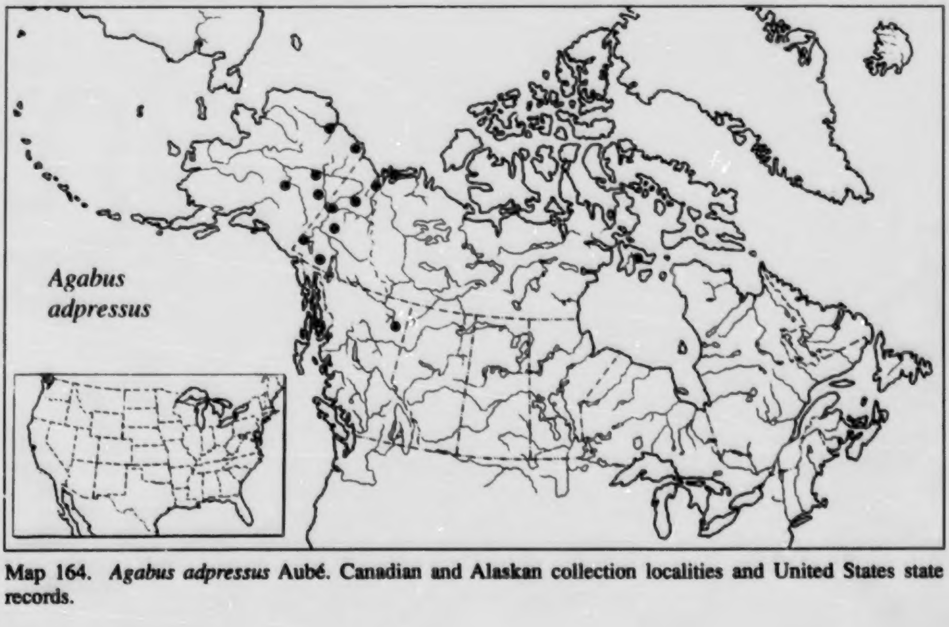
Description. Length = 6.3 to 7.4 mm, width = 3.3 to 3.7 mm, length: width = 1.90 to 2.04. Body outline discontinuous, pronotum at base narrower than elytra across shoulders.

Color piceous, not truly black, some specimens with a faint brassy sheen on pronotum and elytron. Head with large frontal spots and anterior margin rufous; antenna and palpi rufous, lightly infuscate apically or not. Pronotum and elytra laterally rufous to rufopiceous. Legs rufous to rufopiceous.

Sculpture of elytron consisting of polygonal meshes of varied size and shape, most intersections of lines with a distinct puncture; meshes smooth, without microreticulation. Serial punctures large and distinct, some with surrounding area narrowly depressed and punctures more or less foveate. Metacoxal plate with small, irregular meshes.

Pronotum (Fig. 142B) with lateral bead broad, strongly convex and sharply delimited from disc, broadest in basal half and narrowed towards anterior and posterior angles on most specimens; lateral margins subparallel to broadly arcuate at base, relatively strongly converging anteriorly but some specimens with a slight sinuation of margin near anterior angle; hind angle obtuse and broadly rounded, basal margin slightly concave each side of middle; lateral margin in lateral aspect (Fig. 142A) straight or slightly curved upwards on anterior angle, broadly exposing proepipleuron along anterior half. Prosternal process on slightly lower plane than prosternum medially; process pointed apically but not acuminate, smoothly and evenly convex medially, shiny and sparsely setose. Metasternum with anteromedial emargination narrow but deep, extending posteriorly to level of hind margin of mesocoxal cavities; metasternal wing moderately narrow, width of metacoxa: width of metasternal wing = 2.62 to 3.41. Legs slender, metafemur length: width = 3.21 to 3.62; metatibia length: width = 5.22 to 6.0; metatibia with punctation of posteroventral margin various, ranging from a complete row of separated punctures to as few as one or two punctures, ventral face with coarse punctures basally, punctures extending into apical half or not. Metatibial spurs short, length of longer metatibial spur: length metatarsomere 1 = 0.55 to 0.67.

Male protarsomeres 1 to 3 short, narrowly dilated, width protarsomere 1 = 0.16 to 0.18 mm; protarsal ratio = 1.80: 1.55: 1.22: 1.05: 1; protarsomeres 1 to 3 with small elongate adhesive setae beneath; protarsal claws (Fig. 142F) subequal in length, slender and similar in shape, dorsal margin faintly sinuate, ventral margin more definitely so, apex narrow and smoothly curved. Mesotarsomere 5 length: combined length



Map 164. *Agabus adpressus* Aubé. Canadian and Alaskan collection localities and United States state records.

mesotarsomeres 1 to 4 = 0.56 to 0.65. Sternum 6 without longitudinal rugae. Paramere (Fig. 142C) with a large triangular basal sclerite, apical stylus short. Aedeagus (Fig. 142D, E) in lateral view with apex slender and bluntly pointed, shaft broadened subapically; in dorsal aspect straight and evenly narrowed apically.

Ecology. Specimens are typically found among rocks along the margins of streams or shorelines of lakes of the low arctic and northern boreal zones.

Distribution. Map 164. The North American range of this Holarctic species extends from Southampton Island in western Hudson Bay to Alaska.

Agabus clavicornis-group
Figs. 143; 144

Agabus Leach 1817: 69, 72. Type species - *Agabus paykullii* Leach (= *Dytiscus serricornis* Paykull), by monotypy.

Diagnosis. Moderate to large sized, length = 7.3 to 10.0 mm, brown to piceous species. Sculpture of elytron consisting of small, rounded more or less isodiametric meshes. Clypeal bead complete; frontal punctures present or absent. Pronotum with anterior bead obsolete medially; anterior submarginal row of punctures complete; in lateral aspect lateral margin hiding proepipleuron. Prosternum and its process angularly convex to carinate medially; process with apex acuminate, lateral bead not inflated. Metasternum with anteromedial lobe narrow, impressed to level of hind margin of mesocoxae; metasternal wing (Fig. 143B) very narrow, anterior margin of metacoxa extending forward to level of hind margin of mesocoxae. Male antenna (Figs. 143D; 144A) with apical antennomeres enlarged and forming a flattened club. Paramere (Figs. 143E; 144C) stylate but with apical style inconspicuous, basal sclerite large, triangular and strongly sclerotized; aedeagus (Figs. 143G; 144E) small, simple, straight in dorsal aspect or slightly curved to right. Female gonocoxa (Figs. 143C; 144B) laterally flattened, without a lateral ridge.

Comments. This group contains three species, the Holarctic *A. serricornis* Paykull, the Holarctic *A. clavicornis* and the Nearctic *A. antennatus*. *Agabus clavicornis* and *A. serricornis* are of similar habitus and have extensive development of secondary sexual characters such as setal brushes on the legs and broadly expanded pro- and mesotarsomeres. In comparison, *A. antennatus* is much less modified but similarities in sculpture, prosternal process shape, narrow metasternal wings and genitalia indicate it belongs to the same group. Angus (1984) included the Siberian species *A. vereschaginae* Angus 1984 in the group on the basis of males also having clubbed antennae. However, Larson (1989) argued that the species is a member of the *uliginosus*-group, based on sculpture, male protarsal characters and possession of a metafemoral-metasternal type of stridulatory organ.

The species *Carrhydrus crassipes* Fall is probably also a member of the group for most of its peculiar features are extensions of trends shown by *A. clavicornis* and *A. serricornis*. In spite of this, we have treated *Carrhydrus* as a separate genus for the pragmatic purpose that by so doing, the genus *Agabus* is more easily defined. Also, we are not willing to start making changes in the generic classification of the Agabini until a comprehensive review of relationships within the group is undertaken.

45. *Agabus antennatus* Leech 1939

Fig. 143

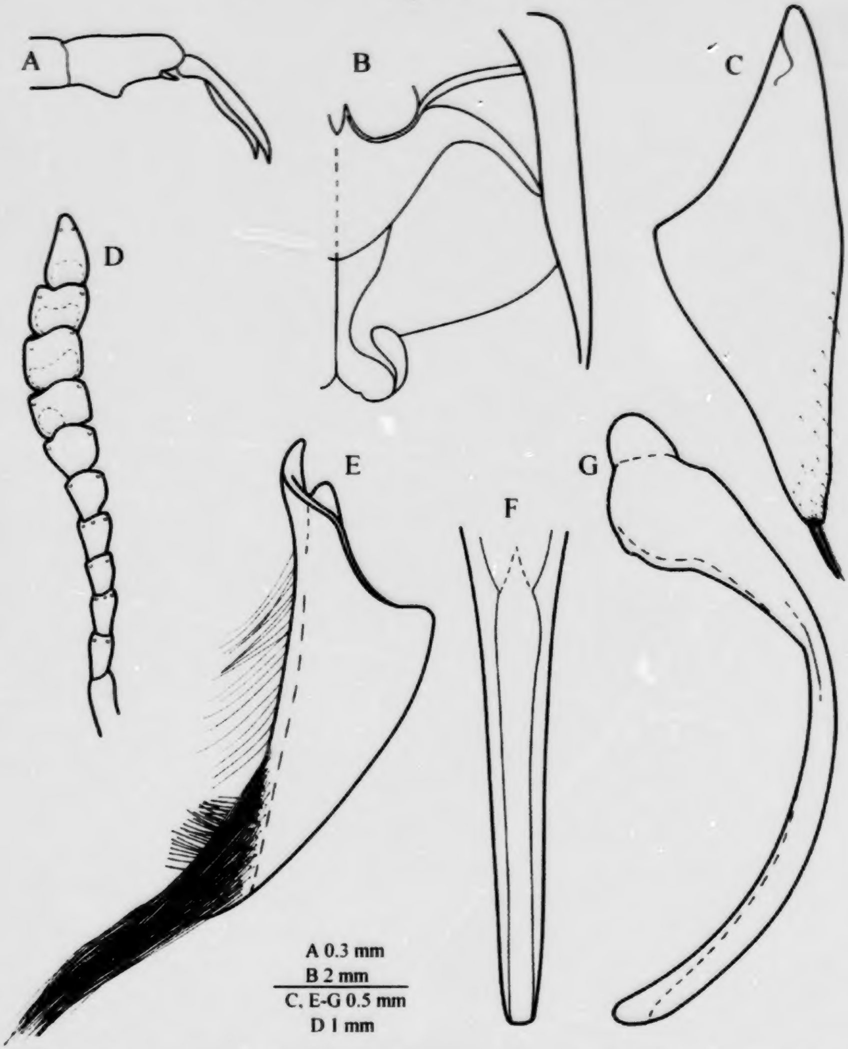


Fig. 143. *Agabus antennatus* A - male protarsal claws, anterior. B - metathorax, ventral. C - female gonocoxa. D - male antenna. E - paramere. F - aedeagus, dorsal. G - aedeagus, lateral.

Agabus clavatus LeConte 1859*a*: 4. Type locality - Loup Fork of Platte R., Nebraska. [not Latreille 1804]. LECTOTYPE (here designated) - male in MCZC labelled: green disc/ Type 6064/ A. clavatus LeC./ Lectotype, des. D. Larson 1984.

Agabus antennatus Leech 1939: 217. New name for *A. clavatus* LeConte.

Selected References. Larson 1975: 368 – 369; Angus 1984: 200; Hilsenhoff 1993*c*: 181.

Description. Length = 6.6 to 8.0 mm, width = 3.4 to 4.3 mm, length: width = 1.82 to 2.02. Moderate size, depressed species with continuous body outline, male smaller and more depressed and parallel-sided than female.

Color brown to piceous. Antenna and palpi pale basally, piceous to black apically. Elytron testaceous to pale brown laterally, disc darker brown. Ventral surface reddish brown except metathorax and basal portions of abdominal sterna darker. Legs yellowish to reddish brown.

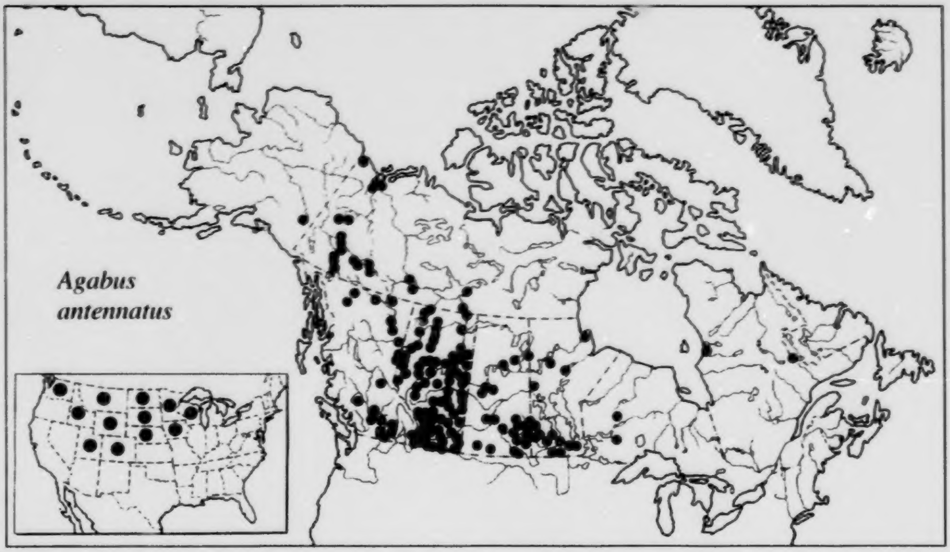
Elytron with sculpture of small hexagonal isodiametric meshes; numerous small punctures evident over disc. Metacoxal plate with coarse irregular lines and finer reticulation, both longitudinally oriented anteriorly and laterally.

Frontal punctures absent. Pronotum with lateral bead moderately broad, slightly narrower than maximum width of antennomere 3; anterolateral angles large and extending relatively far forwards; lateral margin evenly arcuate and continuous in curvature with elytral margin; posterolateral angle slightly produced, basal margin faintly bisinuate each side of middle. Prosternum and its process angularly convex medially, process with apex acute. Metasternum with anteromedial lobe narrow and sharply impressed for reception of apex of prosternal process, impression not quite or actually attaining level of hind margin of mesocoxae; metasternal wings (Fig. 143B) narrow, width of metacoxa: width of metasternal wing = 3.55 to 4.85; metacoxa with anterior margin extending forwards to level of hind margin of mesocoxae. Metafemur evidently punctate but without strioles, its length: width = 2.68 to 2.89. Metatibia length: width = 3.76 to 4.09; metatibia with a few punctures along at least basal third of posteroventral margin, ventral face with coarse punctures on basal half to two-thirds; metatibia ventrally and metatarsus 1 dorsally with minute punctation, inconspicuous on some specimens; length of longer metatibial spur: length metatarsomere 1 = 0.91 to 1.00.

Male antennomeres 5 to 11 expanded laterally and forming a flattened club (Fig. 143D). Legs without setal brushes. Protarsomeres 1 to 3 narrowly dilated, width protarsomere 1 = 0.16 to 0.18 mm, protarsal ratio = 1.80: 1.70: 1.40: 1.10: 1; protarsomere 5 with a distinct ventral tooth (Fig. 143A); protarsal claws (Fig. 143A) slightly elongated, anterior claw rather narrow and straight, posterior claw shorter and distinctly sinuate beneath. Metatarsal ratio = 0.48 to 0.55. Paramere (Fig. 143E) large and triangular, strongly sclerotized, apical style very narrow, small and hidden in apical setae; aedeagus (Fig. 143F, G) narrow, apex bluntly rounded, not twisted in dorsal aspect; basal piece small.

Ecology. This species occurs in a variety of lentic habitats in western North America, ranging from grassland ponds to ponds and cold *Carex* marshes of the boreal zone. However, it is most common in permanent ponds of the parkland and mixed forest zones. The larva has been described by Watts (1970).

Distribution. Map 165. The range extends from western Labrador to the Yukon Territory and eastern Alaska and from the Mackenzie Delta south to Colorado and Utah. The species is abundant in the Great Plains region but has been collected infrequently east of Manitoba.


Agabus antennatus

Map 165. *Agabus antennatus* Leech. Canadian and Alaskan collection localities and United States state records.

46. *Agabus clavicornis* Sharp 1882

Fig. 144

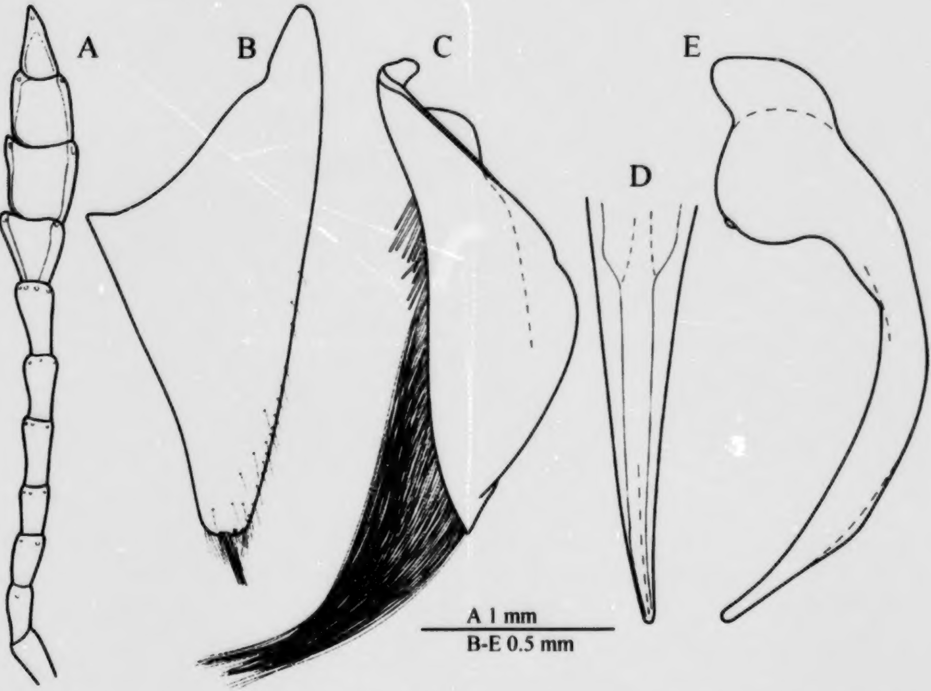

A
B
C
D
E
A 1 mm
B-E 0.5 mm

Fig. 144. *Agabus clavicornis*. A - male antenna. B - female gonocoxa. C - paramere. D - aedeagus, dorsal. E - aedeagus, lateral.

Agabus clavicornis Sharp 1882*a*: 536. Type locality - east Siberia.

Agabus verus Brown 1931: 115. Type locality - Churchill, Manitoba.

Selected References. Angus 1984: 198; Larson and Nilsson 1985: 121; Larson 1997*b*: 508.

Description. Length = 8.7 to 9.8 mm; width = 4.5 to 5.3 mm; length: width = 1.76 to 1.92. A moderately large, convex species, lateral outline slightly discontinuous.

Color rufopiceous to piceous. Head with frontal spots and anterior of clypeus reddish; antenna and palpi pale basally, distinctly infuscate apically.

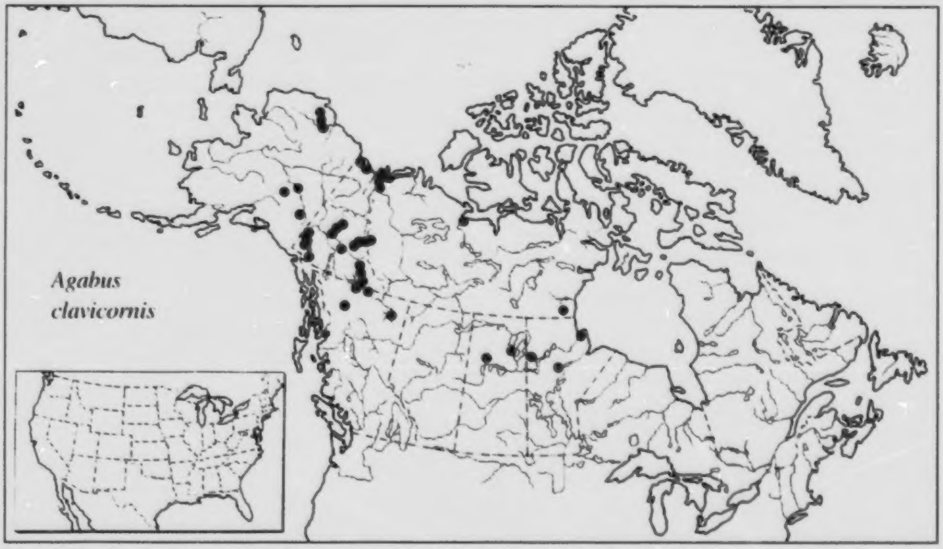
Head and pronotum with fine, irregular reticulation, small punctures present. Elytron with small, rounded and more or less isodiametric meshes, with obscure punctures subequal in size to diameter of meshes. Metacoxal plate with strongly oblique to transverse strioles, interspaces with fine stretched microreticulation. Metafemur coarsely punctate, at least some punctures elongated as short strioles.

Frontal punctures present. Pronotum with lateral bead moderately narrow, gradually narrowing towards posterolateral angle; posterolateral angle obtusely rounded so that lateral margin discontinuous in outline with basal curvature of elytron; pronotum base broadly rounded except for a shallow emargination each side of middle. Prosternum and its process sharply longitudinally ridged, ridge in lateral aspect smoothly convex medially on process; process with apex acuminate. Metasternum with anteromedial lobe narrow, impression just reaching level of hind margin of mesocoxae; metasternal wings narrow, width of metacoxa: width of metasternal wing = 3.76 to 4.92, metacoxa extending forward to level of hind margin of mesocoxal cavity. Metafemur length: width = 3.0 to 3.30; metatibia length: width = 4.22 to 5.33, with a row of punctures along posteroventral margin, mesal face with punctures in basal half, and on some specimens, a few punctures also present distally, without micropunctures. Length longer metatibial spur: length metatarsomere 1 = 0.65 to 0.81.

Male antennomeres 6 to 11 expanded into a club, antennomeres 8 to 11 with ventral surface excavate (Fig. 144A). Protrochanter and profemur with ventral margins bearing a dense brush of setae, setae yellow except longer setae black apically; metatibia along inner margin and metatarsomere 1 along external margin with erect but sparser yellow setal fringes. Pro- and mesotarsomeres 1 to 4 broadly dilated and ventrally bearing large round adhesive setae, protarsomere 1 width = 0.46 to 0.52 mm, protarsal ratio = 3.25: 3.25: 2.75: 1.75: 1; protarsal claws elongate and slightly arcuate, subequal in length and similar in shape except anterior claw slightly broader medially than posterior. Metatarsomere 1 elongate, outer margin slightly and broadly concave, posterolateral angle slightly produced but broadly rounded. Metasternum in lateral aspect with midline concave. Sternum 6 without longitudinal rugae. Paramere (Fig. 144C) with basal sclerite triangular, strongly sclerotized, apical style minute and hidden in setae; aedeagus (Fig. 144D, E) small, simple, evenly arcuate and narrowed to pointed apex in lateral aspect, straight in dorsal aspect.

Ecology. These insects occur amongst *Carex* stalks and mats of decaying grasses and *Carex*, generally in relatively deep (10 to 50 cm) water in permanent boggy, often brown-water, pools and ponds. At the southern limits of the range, in northern British Columbia, the beetles were in cold water habitats, for example at the point of inflow of a small, cold seep into a pool on a north-facing slope. Teneral specimens were collected on 19 July in the southern Yukon Territory.

Distribution. Map 166. The North American range extends from Hudson Bay to Alaska. The species occurs in the arctic mainland south into northern British Columbia, Saskatchewan and Manitoba. No specimens have been collected from northern Alberta or the lower Mackenzie valley in spite of extensive collecting and it may be the species has a bicentric distribution.



Map 166. *Agabus clavicornis* Sharp. Canadian and Alaskan collection localities and United States state records.

Agabus optatus-group
Fig. 145

Colymbinectes Falkenström 1936: 97. Type species - *Colymbinectes ater* Falkenström, by monotypy.

Neoplatynectes Vazirani 1970: 305, 340, 343. Type species - *Platynectes princeps* Régimbart, by original designation.

Diagnosis. Moderate sized species, length = 6.8 to 8.9 mm, form ovate and depressed, lateral outline continuous. Color dark, palpi and antenna not infuscate, elytron with a postmedian and a subapical pale spot. Elytron with sculpture consisting of large, irregular meshes, meshes finely punctate but without microreticulation. Clypeal bead complete; frontal punctures absent. Pronotum with anterior bead obsolete medially; anterior sublateral row of punctures complete; lateral bead moderate to broad; posterolateral angle more or less right, basal margin slightly arcuate and at most faintly concave each side of middle; lateral margin in lateral aspect hiding proepipleuron. Prosternum and its process in same plane, process very broad and flat to slightly and evenly convex medially, sharply pointed apically, lateral bead well developed but not distinctly dilated behind procoxae. Metasternum with anteromedial lobe broad, deeply and sharply incised for reception of prosternal process but impression not quite reaching level of hind margin of mesocoxal cavities; metasternal wings narrow. Metatibia with punctation reduced, a few small punctures basally on posteroventral margin, mesal face largely impunctate. Male protarsi very slightly dilated; protarsal claws slender.

Parameres (Fig. 145A, E) stylate; aedeagus (Fig. 145B, C, F, G) without a subapical spine, apex in dorsal aspect twisted to right. Gonocoxa (Fig. 145D) laterally compressed, triangular.

Comments. Larson (1989) proposed the *A. obtusatus*-group for two North American species. However, Nilsson (1996) recognized that these species had an affinity with a group of Palaearctic species that Zimmermann (1934) had placed in the *Gaurodytes optatus*-group. As defined by Nilsson (1996), this group is Holarctic with two species in North America and ten species in Asia. The North American species are distinctive enough to be placed in their own subgroup, the *obtusatus*-subgroup.

47. *Agabus obtusatus* (Say 1823)

Fig. 145A – D

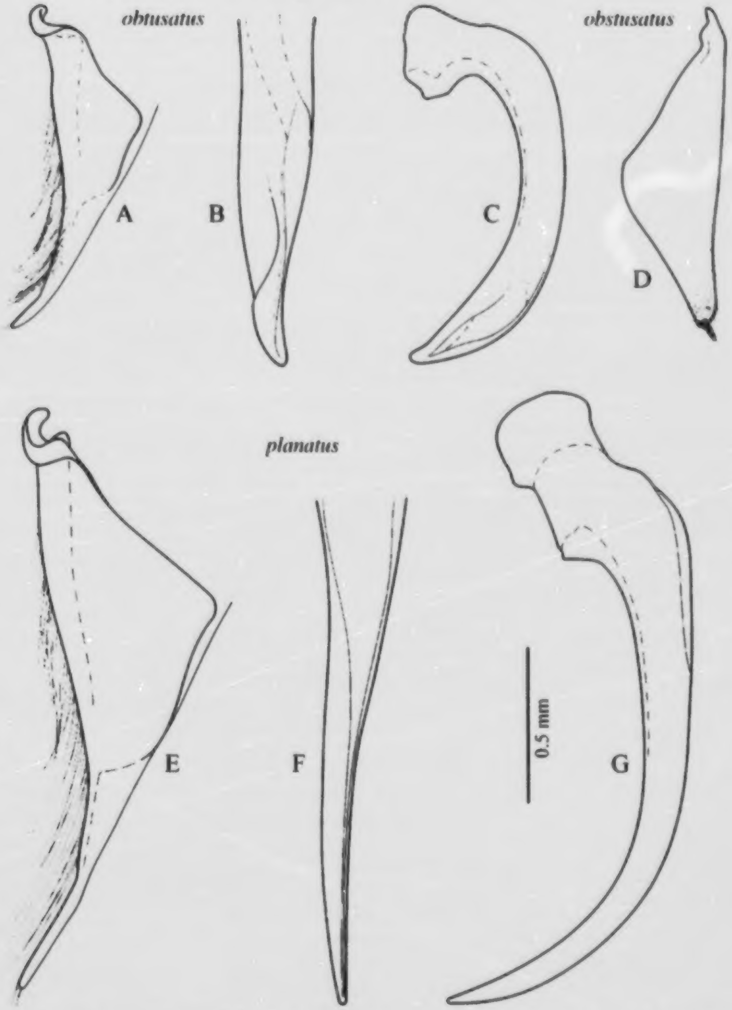


Fig. 145. *Agabus optatus*-group. A – D - *A. obtusatus*. A - paramere. B - aedeagus, dorsal. C - aedeagus, lateral. D - female gonocoxa. E – G - *A. planatus*. E - paramere. F - aedeagus, dorsal. G - aedeagus, lateral.

Colymbetes obtusatus Say 1823: 99 – 100. Type locality - Germantown, New York.

Selected References. Sharp 1882*a*: 502 – 503; Fall 1922: 12; Michael and Matta 1977: 27 – 28; Nilsson 1996: 627 – 629.

Description. Length = 6.8 to 7.3 mm, width = 3.6 to 4.1 mm, length: width = 1.75 to 1.88. Broadly ovate but sides only slightly arcuate to almost parallel medially, outline continuous, somewhat depressed.

Color piceous to black. Head with frontal spots and anterior margin rufous; antenna and palpi pale, without apical infuscation. Pronotum and elytra diffusely paler laterally; elytron with a postmedial and subapical pale spot, postmedial spot elongate and some specimens also with a smaller adjacent mesal spot. Legs rufous to rufopiceous.

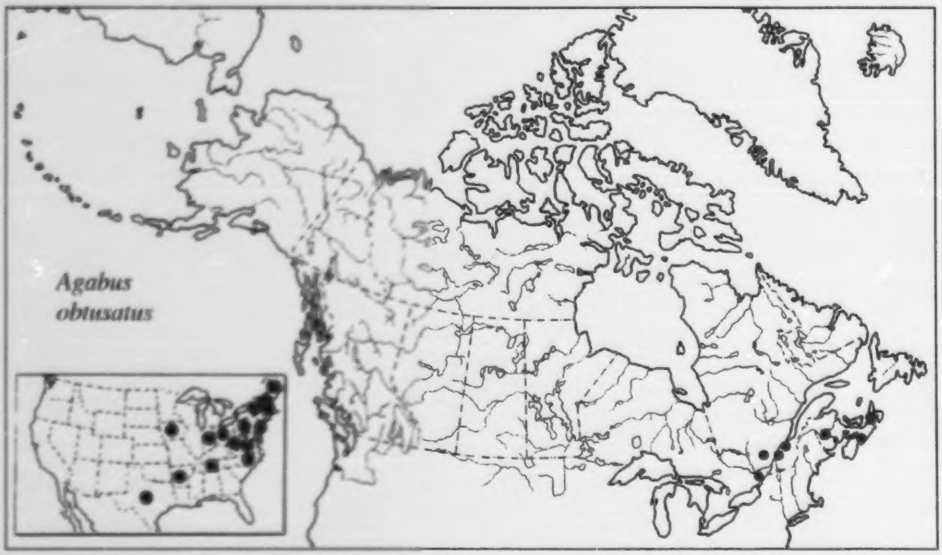
Elytron with sculpture consisting of moderately large meshes of irregular polygonal shape; meshes flat and smooth with sparse, fine micropunctures. Metacoxal plate with coarse meshes, longitudinally stretched anteriorly and laterally, with lightly impressed microreticulation on some specimens.

Pronotum with lateral bead narrow, about one-half maximum width of a medial antennomere. Prosternum and its process in same plane; prosternum with a broadly angular medial convexity; process broad, almost flat to lowly and evenly convex, surface smooth, micropunctate but without setae, apex sharply pointed, lateral bead strong behind procoxae but not distinctly inflated. Metasternal wing narrow, width of metacoxa: width metasternal wing = 3.40 to 4.50, metacoxa with anterior margin approaching but not attaining level of hind margin of mesocoxal cavities. Metafemur clavate, metafemur length: width = 2.74 to 3.06, without distinct punctures or strioles; posteroapical angle not produced; metatibia length: width = 4.32 to 5.06, posteroventral margin and ventral face impunctate except for a few small punctures at base; longer metatibial spur slightly shorter than metatarsomere 1, length spur: length metatarsomere 1 = 0.80 to 0.95.

Male protarsus very narrow, width protarsomere 1 = 0.12 to 0.14 mm, protarsal ratio = 1.47: 1.34: 1.25: 1.10: 1; protarsomeres 1 to 3 ventrally with a small number of similar sized adhesive setae; protarsal claws shorter than protarsomere 5, in lateral aspect anterior claw slightly broader than posterior, both evenly and gently arcuate. Mesotarsomere 5 short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.49. Sternum 6 lightly sculptured, without longitudinal rugae. Paramere (Fig. 145A) stylate, basal sclerite lightly sclerotized, apical sclerite very long and slender; aedeagus (Fig. 145B, C) in lateral aspect short and slightly broadened subapically, with deep lateral grooves on each side; in dorsal aspect apex twisted to right.

Ecology. Michael and Matta (1977) recorded the species from a variety of habitats but generally sites of standing or very slowly flowing water and probably deep organic substrates. In Nova Scotia, specimens were collected from small pools in peaty soil along an old woods road.

Distribution. Map 167. The range extends from Nova Scotia west to southern Ontario and south to North Carolina, Tennessee, Arkansas and eastern Texas. A record from Iowa (Fall 1922) is based on a specimen labelled "Iow." in MCZC.



Map 167. *Agabus obtusatus* (Say). Canadian and Alaskan collection localities and United States state records.

48. *Agabus planatus* Sharp 1882

Fig. 144.

Agabus planatus Sharp 1882*a*: 503. Type locality - "North America".

Selected References. Fall 1922: 12–13; Michael and Matta 1977: 28; Nilsson 1996: 629.

Description. Length = 7.7 to 8.9 mm, width = 4.1 to 4.8 mm, length: width = 1.80 to 1.87. Broadly ovate but sides only slightly arcuate medially, outline continuous, somewhat depressed.

Color rufopiceous to black. Head with frontal spots, anterior margin and ventral surface rufous; antenna and palpi pale, without apical infuscation. Pronotum and elytra diffusely paler laterally, elytron with a postmedial and subapical pale spot. Legs rufous to rufopiceous.

Elytron with sculpture consisting of moderately large meshes of irregular polygonal shape; meshes flat and smooth with sparse, fine micropunctures. Metacoxal plate with coarse meshes, longitudinally stretched anteriorly and laterally, with lightly impressed microreticulation on some specimens.

Pronotum with lateral bead very broad medially, subequal to or broader than maximum width of a medial antennomere; narrowed towards both anterior and posterior angles. Prosternum and its process in same plane; prosternum angularly convex medially; process broad with convexity lower and more even, surface smooth, micropunctate but without setae, apex sharply pointed, lateral bead broad behind procoxae but not distinctly inflated. Metasternal wing narrow, width of metacoxa: width metasternal wing = 3.79 to 4.10, metacoxa with anterior margin approaching but not attaining level of hind margin of mesocoxal cavities. Metafemur clavate, metafemur length: width = 2.75 to 2.82, without distinct punctures or strioles; posteroapical angle not produced; metatibia length: width = 4.75 to 4.90, posteroventral margin and ventral face impunctate except for a few small punctures at base; longer metatibial spur slightly shorter than metatarsomere 1, length spur: length metatarsomere 1 = 0.92 to 0.95.

Male protarsus narrow, width protarsomere 1 = 0.15 to 0.18 mm, protarsal ratio = 1.53: 1.42: 1.25: 1.06: 1; protarsomeres 1 to 3 ventrally with small adhesive setae basally and laterally, setae larger apically; protarsal claws elongate and slender, about one and one-quarter times as long as protarsomere 5, strongly curved at base otherwise slightly and evenly arcuate in lateral aspect. Mesotarsus short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.55 to 0.62. Sternum 6 lightly sculptured, without longitudinal rugae. Aedeagus (Fig. 145F, G) in lateral aspect narrow, elongate and strongly curved in apical half; dorsal groove curved to right apically; paramere (Fig. 145E) stylate, basal sclerite lightly sclerotized, apical sclerite very long and slender.

Ecology. Fall (1922) described this as "an extremely local species", for he had seen specimens from only two localities, Staten Island, New York, and Marion, Massachusetts. The specimens from Marion were collected from "the nearly dry bed of a small brook". Two specimens were collected along with a series of *Neoporus blanchardi* from the margins of a small, low gradient forest stream in Cumberland Co., New Jersey. The beetles were on peaty substrates and among emergent sedges at the stream margin. It appears as though this is a lotic species that occurs in small, low gradient and perhaps intermittent streams.

Distribution. The range is rather restricted for specimens are known from along the Atlantic seaboard of the United States, from Massachusetts to New Jersey and Maryland and inland to eastern Tennessee.

Agabus labiatus-group
Fig. 146

Eriglenus Thomson 1859: 14. Type species - *Dytiscus abbreviatus* Fabricius (= *Dytiscus undulatus* Schrank), by original designation.

Apator Semenov 1899: 512. Type species - *Agabus kessleri* Hochhuth (= *Colymbetes bifarius* Kirby), by monotypy.

Diagnosis. Size small, length = 5.5 to 6.7 mm, shape elongate oval, body outline continuous. Color brown to piceous or black; antenna and palpi pale, infuscate apically. Sculpture various, meshes small, isodiametric to irregular, faint to distinct punctures present at some intersections of lines. Clypeus with anterior bead complete or narrowly and irregularly broken medially; frontal punctures present. Pronotum with anterior bead present or obsolete; anterior submarginal row of punctures complete or narrowly broken medially; lateral bead of moderate width to relatively wide, narrowed or obsolete on anterolateral angle. Prosternum and its process angularly convex in cross-section, in lateral aspect process stepped down from plane of prosternum; process with apex sharply pointed but not acuminate, surface with sparse setiferous punctures, lateral bead not inflated. Metasternum with anteromedial impression sharply impressed, extending posteriorly to level of hind margin of mesocoxae; metasternal wings narrow. Metafemur without strioles. Metatibia with posteroventral and ventral punctation present at base only, surface with variously developed micropunctation; metatibial spurs slightly shorter than to subequal in length to metatarsomere 1. Metatarsomeres 1 and 2 with fine dorsal micropunctation. Male protarsomeres 1 to 3 narrowly dilated, with small, oval adhesive setae beneath; protarsal claws slightly elongated and relatively straight. Parameres stylate (Fig. 146A, E), basal sclerite large and triangular or narrower and transverse, apical sclerite distinct; aedeagus simple, slender, evenly arcuate in lateral aspect, in dorsal aspect shaft straight or apex bent slightly to right. Gonocoxae laterally compressed, triangular to trapezoidal (Fig. 146D, H).

Comments. The inclusion of *A. bifarius* in the *A. labiatus*-group is based on the following similarities: size, habitus, shape of prosternal process, narrow metasternal wings, micropunctation of metatibia and metatarsomeres, similar form of male protarsal claws, and simple, apically narrowed aedeagus. *Agabus bifarius* differs from other members of the *A. labiatus*-group in its aciculate sculpture, lack of setal brush on the male protibia and smaller size of the basal sclerite of the paramere. Leech (1942*a)* included *A. bifarius* in the *labiatus*-group but the differences were enough to prompt Larson (1989) and Nilsson (1990) to recognize the monotypic *A. bifarious*- group. However, the large number of similarities indicate that Leech was probably correct and that the species is sister to the *A. labiatus*-group and its inclusion with this assemblage of species is the most effective way of showing its systematic placement. Nilsson (1990) revised the *A. labiatus*-group s. str. and recognized six species, all of which occur in the Palaearctic region and one, *A. pallens*, also occurs in the western Nearctic.

The species are univoltine, overwintering as adults and breeding in the spring (Nilsson 1986*a*; Hilsenhoff 1993*c*). However, the larva of *A. bifarius* seem to differ from those of other group members by having very short urogomphi (Watts 1970; Hilsenhoff 1993*c;* Nilsson 1987*b).*

49. *Agabus bifarius* (Kirby 1837)

Fig. 146A – D

Colymbetes bifarius Kirby 1837: 71. Type locality - H.T. (Hudson Bay Territory), North America. Type - BMNH, female, examined.

Selected References. Leech 1942*a*: 87; Leech 1942*b*: 357; Carr and Leech 1966: 548; Larson 1975: 367 – 368; Larson and Nilsson 1985: 121; Hilsenhoff 1993*c*: 182; Larson 1997*b*: 508.

Description. Length = 6.2 to 6.7 mm, width = 3.3 to 3.7 mm, length: width = 1.82 to 1.95. A small, ovate species;

Body mainly rufopiceous to black. Head with frontal spots and anterior margin rufous; antenna and palpi yellow basally, infuscate apically. Pronotum and elytron with lateral margin slightly paler, dark rufous to piceous. Ventral surface mainly piceous to black. Legs rufous, many specimens with femora infuscate medially and basally.

Body of most specimens with aciculate sculpture, best seen on elytron where it consists of short, separated longitudinal lines on base but lines oblique to transverse medially and apically; aciculate lines also on lateral portions of pronotum, epipleuron, metacoxal plates and abdominal sterna; aciculations may be very reduced on some specimens, or some females with lines deep and dense, many merging or interconnected

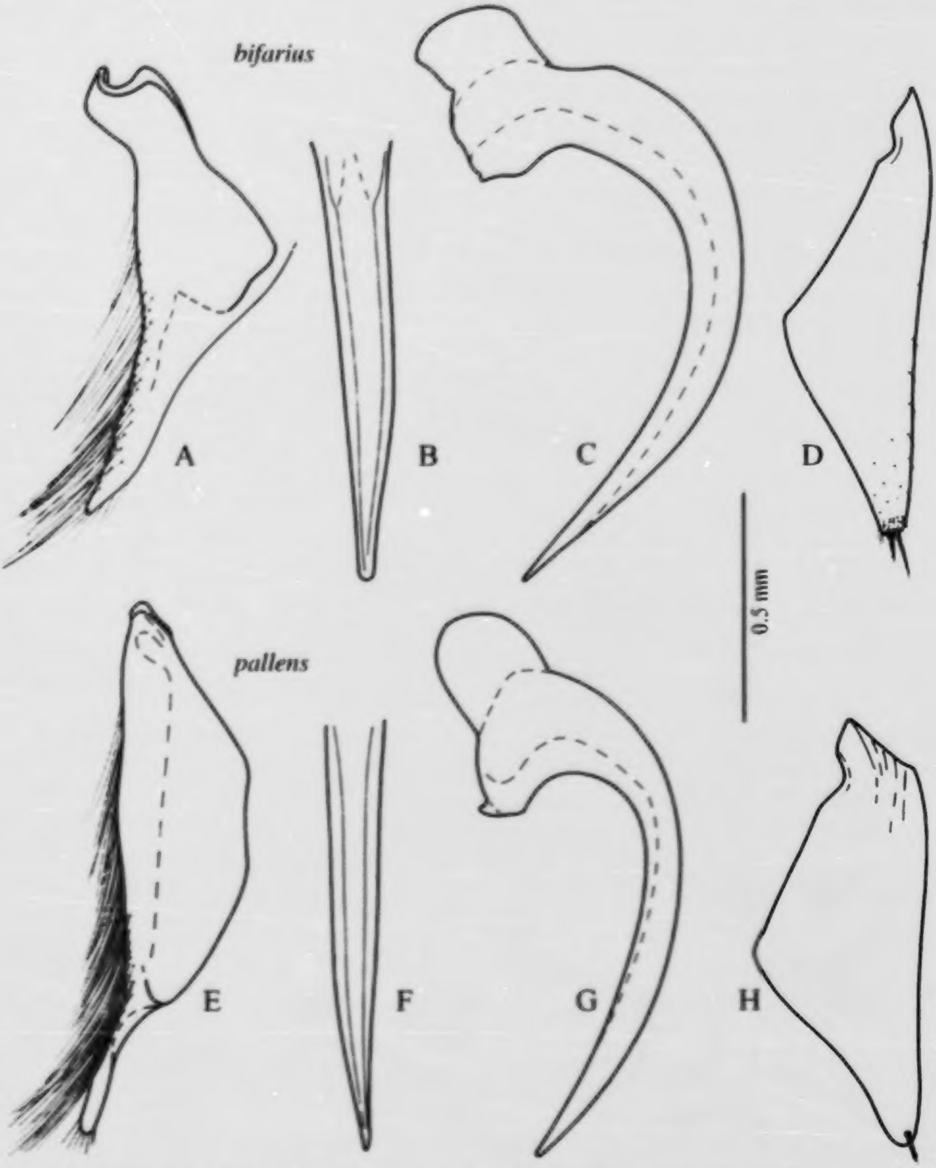


Fig. 146. *Agabus labiatus*-group. A – D - *A. bifarius*. A - paramere. B - aedeagus, dorsal. C - aedeagus, lateral. D - female gonocoxa. E – H - *A. pallens*. E - paramere. F - aedeagus, dorsal. G - aedeagus, lateral. H - gonocoxa.

but not forming definite meshes. Elytron with fine, more or less isodiametric microreticulation and small, inconspicuous punctures, stronger on female than on male. Metafemur without strioles.

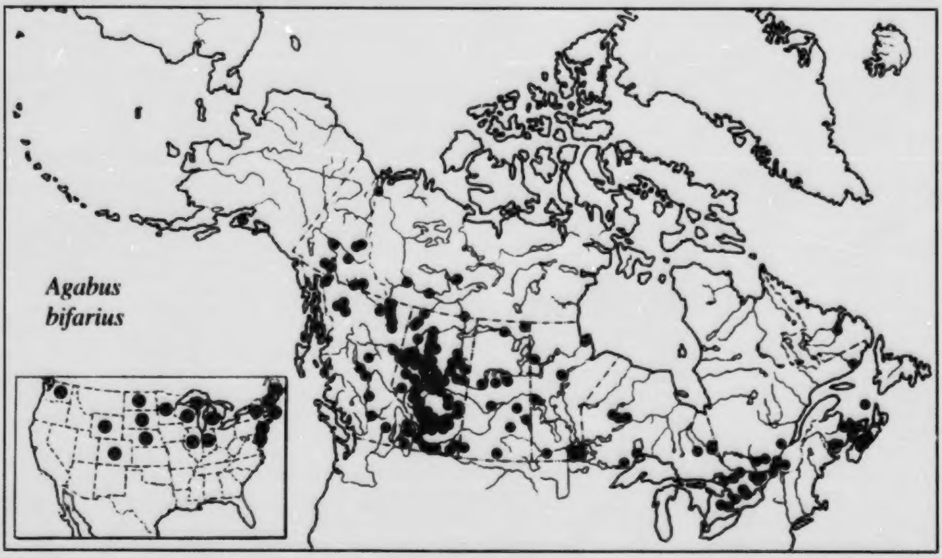
Pronotum with lateral bead broad, at widest subequal in width to maximum width of a medial antennomere, clearly delimited posteriorly and medially but becoming indistinct towards front angle. Metasternal wings very narrow, width of metacoxa: width metasternal wing = 2.95 to 4.07. Metafemur strongly clavate, posteroapical angle triangularly produced. Metatibia with posteroventral punctures restricted to basal third, mesal face with coarse punctures at base only, most specimens with very faint micropunctures. Metatibial spurs slightly shorter to subequal in length to metatarsomere 1. Metatarsomeres 1 and 2 with very fine, sparse punctation on dorsal surface.

Male profemur without a ventral brush of setae. Protarsomere 1 width = 0.14 to 0.16 mm; protarsal ratio = 1.97: 1.67: 1.41: 1.12: 1; protarsal claws slightly elongate and straight medially. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.54 to 0.60. Aedeagus (Fig. 146B, C) simple, evenly arcuate in lateral aspect and gradually narrowing to pointed apex, in dorsal aspect apex slightly curved to right, apex narrowly rounded; paramere (Fig. 146A) stylate, basal sclerite transverse, apical sclerite slender.

Comments. The peculiar autapomorphic sculpture gives this species a very distinctive appearance. However, on balance it shares many characteristics with members of the *A. labiatus*- group as discussed above.

Ecology. This species occurs amongst emergent grasses and sedges at the margin of a variety of lentic habitats but it is especially characteristic of the margins of shallow, exposed, vernal ponds. The beetles become active very early in the spring and the larval stages are completed by early summer. This species is unusual in that it is wing dimorphic, with many specimens possessing flight wings which are of reduced length. This variation seems to have a geographical basis but has not been studied in sufficient detail. The larva has been described by Watts (1970).

Distribution. Map 168. This Holarctic species occurs from Labrador and the Maritime Provinces to British Columbia and Alaska, and south to New Jersey, Illinois and Colorado. The Palaearctic range extends across most of Russia.



Map 168. *Agabus bifarius* (Kirby). Canadian and Alaskan collection localities and United States state records.

50. *Agabus pallens* Poppius 1905

Fig. 146E – H

Agabus femoralis Paykull, var. *pallens* Poppius 1905. Type locality - USSR, Yakutian ASSR, Olekminsk.

Selected References. Leech 1938: 123 (as *A. hudsonicus* Leech); Larson and Nilsson 1985: 126 (as *A. zaitzewi* Poppius 1909); Nilsson 1990: 150 – 151; Larson 1997*b*: 511 (as *A. zaitzewi*).

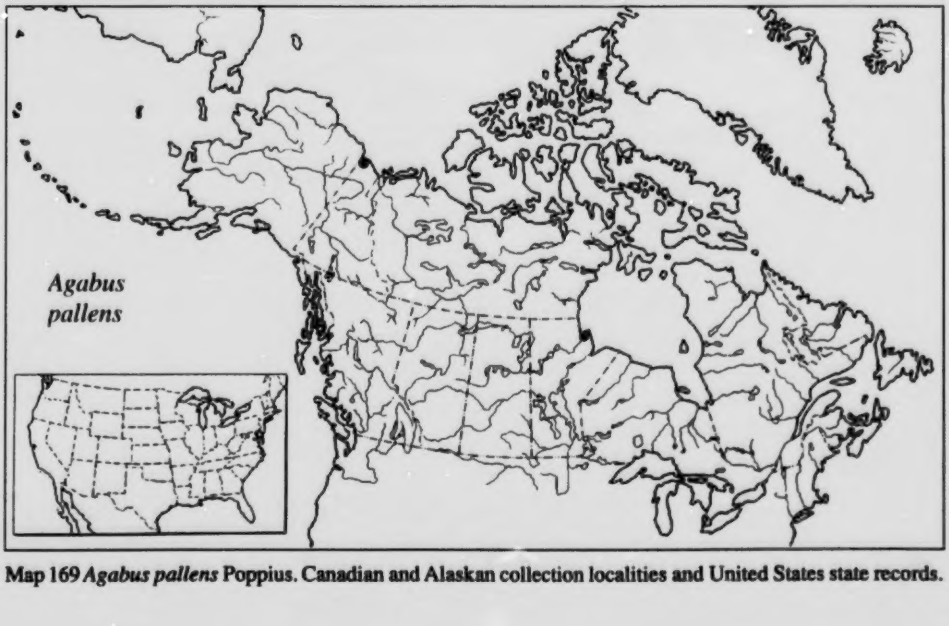
Description. Length = 5.5 to 6.4 mm, width = 3.0 to 3.4 mm, length: width = 1.80 to 1.91. Small species; lateral outline continuous in dorsal aspect.

Color of body mainly pale brown to reddish brown, darker brown to piceous on medial and posterior margins of head, gula, pterothorax and abdomen. Antenna and palpi infuscate apically.

Elytron with fine lines forming small polygonal meshes of very irregular size and shape, meshes smooth, many intersections with a puncture.

Pronotum with lateral bead at maximum width about one-half maximum width of a middle antennomere, bead narrowing anteriorly. Metasternal wing narrow, width of metacoxa: width metasternal wing = 2.90 to 3.87. Metafemur length: width = 2.96 to 3.23, posteroapical angle only slightly produced. Metatibia with ventral surface densely micropunctate; length metatibial spur: length metatarsomere 1 = 0.87 to 0.92. Metatarsomeres 1 and 2 with dorsal surface finely micropunctate.

Male profemur with a dense brush of pale setae on ventral surface. Protarsomeres 1 to 3 narrowly dilated, protarsal ratio = 1.79: 1.57: 1.34: 1.09: 1; protarsal claws subequal in length, anterior broader than posterior, both relatively



Map 169 *Agabus pallens* Poppius. Canadian and Alaskan collection localities and United States state records.

straight medially. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46 to 0.49. Aedeagus (Fig. 146F, G) simple, slender and evenly narrowing to pointed apex in both lateral and dorsal aspects, apex straight or very slightly bent to right; paramere (Fig. 146E) with basal sclerite large and triangular, apical sclerite flattened and somewhat broadened apically. Gonocoxa (Fig. 146H) rather broad in basal half, somewhat trapezoidal in shape.

Ecology. The habitat is unknown but the species probably occurs in the vegetation-rich margin of small tundra ponds. Several specimens from Churchill were collected in a screen trap placed amongst *Salix*, grasses and aquatic vegetation in a shallow stream.

Distribution. Map 169. This Holarctic species has a wide distribution in low arctic and northern boreal regions, occurring from the Kanin Peninsula to Siberia in the Palaearctic, and from Alaska to Hudson Bay in the Nearctic.

Agabus aeruginosus-group
Fig. 147

Diagnosis. Moderately small species, length = 6.0 to 7.8 mm. Body broadly oval, lateral outline continuous in dorsal aspect. Color rufous to piceous, not black. Sculpture fine, elytron with small meshes which vary from almost isodiametric to distinctly irregular, with some tendency of transverse stretching or arrangement; surface finely punctate. Metafemur without strioles. Clypeus with anterior bead complete or at most narrowly broken medially; frontal punctures absent. Pronotum with lateral bead sharply defined, continuous; anterior submarginal series of punctures complete or narrowly broken. Prosternum and its process in same plane in lateral aspect; prosternum strongly convex medially, process more evenly and moderately convex; lateral bead not inflated; apex sharply pointed. Metasternum with anteromedial impression well defined but short and not attaining level of hind margin of mesocoxae; metasternal wings of moderate width. Metafemur clavate, broadly expanded apically with large posteroapical lamella; metafemoral comb elongate with proximal setae rather widely separated, setae more closely spaced apically. Metatibial spurs large, longer spur longer than metatarsomere 1.

Male protarsi narrowly dilated; protarsomeres 1 to 3 with small, oval scales beneath; anterior protarsal claw simple (Fig. 147A, B), not toothed but slightly broader and more angularly arcuate ventrally than posterior claw. Mesotarsomere 5 short. Stridulatory organ present consisting of suture between sterna 2 and 3 raised on each side of middle into a low ridge and anterodorsal margin of metafemur with an oblique series of transverse grooves which can be drawn over ridge. Paramere (Fig. 147C, G, J) in lateral aspect strap-like, broadly sclerotized to apex, ventral and mesal surfaces variously setose; aedeagus (Fig. 147F, I, M) with basal apodemes large, in dorsal aspect apex twisted to right, dorsal groove lying to right

Comments. This small group of three species is restricted to temperate eastern North America. The group is probably sister to the *disintegratus*-group as there is a similarity in the general form of the male genitalia and members of both groups possess similar stridulatory organs. The insects occur in vegetation-rich margins of small, often temporary, ponds. Larvae of members of this group have been described by Matta (1986).

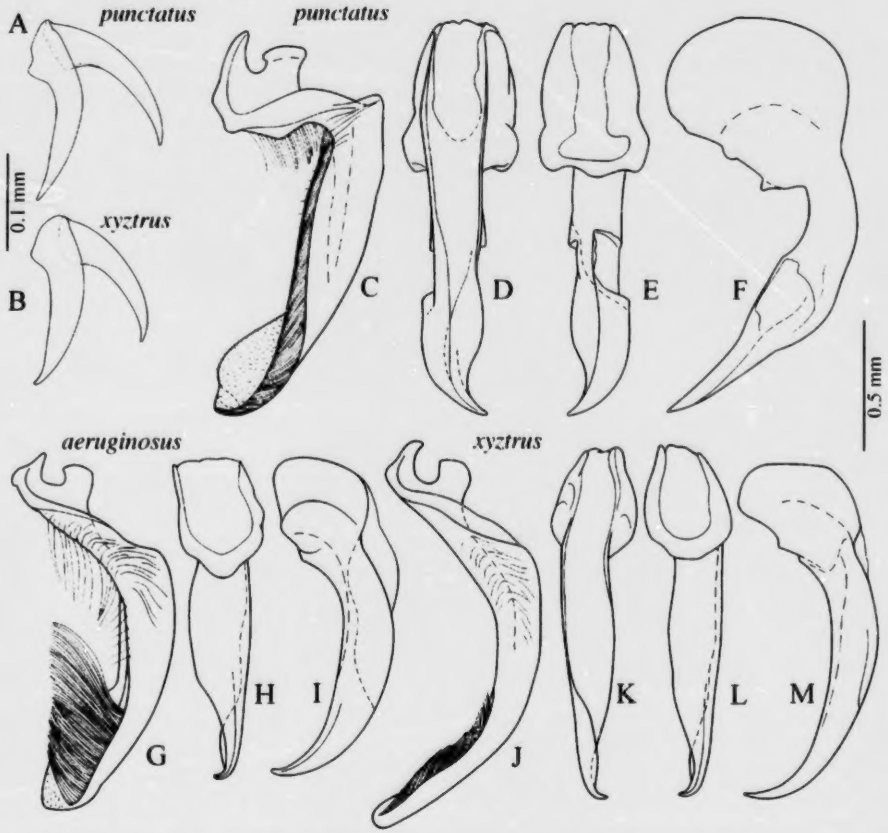


Fig. 147. *Agabus aeruginosus*-group. A, C – F - *A. punctatus*. A - male protarsal claws, anterior. C - paramere. D - aedeagus, dorsal. E - aedeagus, ventral. F - aedeagus, lateral. B, J – M - *A. xyztrus*. B - male protarsal claws, anterior. J - paramere. K - aedeagus, dorsal. L - aedeagus, ventral. M - aedeagus, lateral. G – I - *A. aeruginosus*. G - paramere. H - aedeagus, ventral. I - aedeagus, lateral.

51. *Agabus punctatus* Melsheimer
Fig. 147A, C – F

Agabus punctatus Melsheimer 1844: 27 – 28. LECTOTYPE, here selected - male in LeConte Collection, MCZC, labelled: pink disc/ 3347/ punctatus Mels./ Lectotype *Agabus punctatus* Melsh. des. D. Larson 1984.

Selected Reference. Fall 1922: 16.

Description. Length = 6.2 to 7.7 mm, width = 3.5 to 4.2 mm, length: width = 1.69 to 1.86. Body in dorsal aspect with outline continuous.

Color reddish brown to piceous. Head darkened between eyes and along posterior margin, ventral surface red except gula piceous; palpi and antenna yellow except apical antennomere infuscate. Pronotum and elytra dark reddish brown to piceous medially, lateral margins reddish, elytron of some specimens with a small subapical pale spot (may be visible only when elytron is lifted). Ventral surface reddish brown to piceous. Legs pale brown to dark red, metafemur darkened.

Sculpture fine. Head with small, rounded meshes of irregular size and shape, meshes subgranular medially. Pronotum with meshes small, of irregular size and shape medially, laterally more regular and rounded; surface with small punctures situated at some intersections of lines. Elytron with meshes small, rounded but slightly irregular in size, many transversely enlarged, with tendency to form transverse series; with small punctures about equal in diameter to smaller meshes; serial punctures much larger than diameter of meshes and very conspicuous. Metacoxal plate with coarse, irregular sculpture.

Pronotum with lateral bead complete, sharply defined, about two-thirds maximum width of a middle antennomere; base slightly bisinuate, concave near hind angle and posterolateral angle slightly produced and acute. Prosternum strongly convex medially but not acutely carinate; process more broadly and evenly convex, its surface smooth and shiny medially, setose laterally; lateral bead distinct but not inflated basally; apex sharply pointed but not acuminate. Metasternum with anteromedial impression sharply impressed but short and not attaining level of hind margin of mesocoxae; metacoxal wing narrow laterally, width of metacoxa: width metasternal wing = 2.69 to 3.70, anterior margin of metacoxa not attaining level of hind margin of mesocoxal cavities. Mesotibia in anterior aspect distinctly widened from base to apex. Metafemur length: width = 2.37 to 2.69, clavate, with a large apical lamella, hind margin almost straight or only slightly curved outwards at posteroapical angle; setal comb elongate, with proximate punctures distant from one another; surface without strioles. Metatibia with posteroventral margin impunctate or some specimens with one or two isolated punctures on basal half; medially with coarse punctures restricted to base, remainder of surface evidently micropunctate; metatibial spurs very large, distinctly longer than metatarsomere 1, length spur: length metatarsomere 1 = 1.04 to 1.37. Metatarsomere 1 with 1 to 6 setae ventrolateral setae.

Male protarsus narrow, protarsal ratio = 2.02 : 1.74 : 1.49 : 1.20 : 1; protarsomeres 1 to 3 ventrally bearing small, oval scales; claws (Fig. 147A) slightly modified, anterior claw slightly broader than posterior, its ventral margin angularly arcuate. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.49. Middle legs lacking setal brushes. Metatibial spurs broad, longer spur broad and flattened ventrally. Abdomen with suture between sterna 2 and 3 raised mediolaterally into a low ridge, anterodorsal margin of metafemur which swings over ridge with 15 to 20 short, oblique grooves. Sternum 6 with an oblique line of setae each side of middle, area between setae flattened or slightly concave, hind margin completely margined. Aedeagus (Fig. 147D – F) with a large depression on left side, in dorsal aspect apex twisted to right, dorsal groove lying to right; paramere (Fig. 147C) strongly and broadly sclerotized to apex (strap-like in lateral aspect), with a right angled bend near base, basal portion with ventral surface bearing long setae, apical portion densely fringed with long setae ventrolaterally, mesoventral face with dense field of short, sucker tipped setae apically.

Female lacking stridulatory organ. Sternum 6 with sublateral line of setae less well developed than in male. Metatibial spur slenderer than that of male. Gonocoxa narrow, narrowly rounded apically; surface smooth and shiny with sparse short setae except for elongate apical group.

Ecology. Specimens have been collected from small, vernal ponds.

Distribution. The range extends from Massachusetts to South Carolina and west to Kansas and eastern Texas. There are no Canadian records but it is likely the species will be found in southern Ontario as there are records from all adjacent states.

52. *Agabus aeruginosus* Aubé 1838

Fig. 147G – I

Agabus aeruginosus Aubé 1838*a*: 298 – 299. Type locality – "États-Unis". Type specimen not located.

Selected Reference. Hilsenhoff 1993*c*: 180.

Description. Size small, length = 6.0 to 7.1 mm, width = 3.3 to 3.8 mm; length: width - 1.74 to 1.92. Habitus similar to that of *A. punctatus*.

Color of head red, darker medially and posteriorly; ventrally red except gula dark on most specimens; palpi yellow with apical palpomere of each palpus infuscate; antenna yellow with at least apical antennomere infuscate apically, most specimens with light infuscation evident from antennomere 5. Pronotum broadly red laterally, darkened medially on disc. Elytron with epipleuron and lateral margin red, darker medially. Ventral surface red to piceous, pterothorax and abdominal sterna basomedially darkened. Legs reddish, metatibia and tarsi darkened.

Head with small meshes of irregular shape, lines deeper and meshes somewhat granular medially; punctures present at many intersections of lines but somewhat obscured by depth of lines. Pronotum with similar small, irregular meshes but not so granulate, more even and rounded laterally; fine punctures present but obscure. Elytron with lines fine, meshes larger than in *A. punctatus* and more irregular in shape, many meshes, especially apically, transverse in shape or in evident transverse series; small punctures present at many intersections of lines. Metacoxal plate with oblique or longitudinal lines strongest, interspaces with variously effaced microreticulation. Sternum 6 with small but deep punctures laterally, medially these punctures lengthened into transverse, separated strioles; interspaces mainly smooth and shiny or with very faint or obsolete transverse lines.

Structurally similar to *A. punctatus*, differing as follows. Antenna slightly more robust, apical antennomeres slightly broader; prosternal process slightly less convex on average. Metasternal wing narrower, width of metacoxa: width metasternal wing = 3.50 to 5.07. Metafemur length: width = 2.00 to 2.41. Metatibial spurs long, length metatibial spur: length metatarsomere 1 = 1.07 to 1.25.

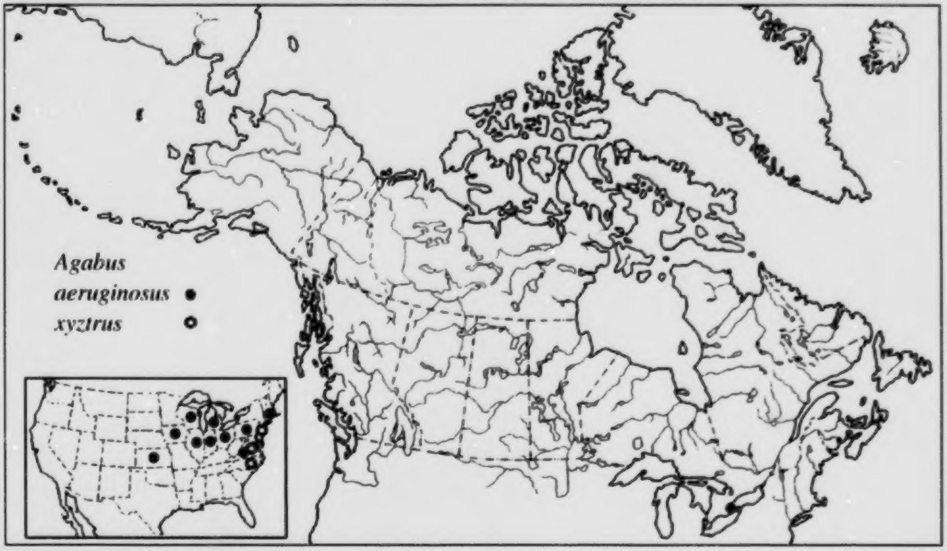
Male protarsus very narrow, protarsal ratio = 1.47 : 1.44 : 1.29 : 1.15 : 1; protarsomeres 1 to 3 each with an apical transverse row of small oval scales; anterior protarsal claw slightly broader than posterior, angularly arcuate ventrally. Mesofemur with ventral margin bearing a dense row of long yellow setae; mesotibia in anterior aspect slender, inner face faintly sinuate and bearing a dense brush of yellow setae of shorter length than those of mesofemur. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.44 to 0.53. Metafemur with hind margin arcuate, posteroapical angle acutely produced; anterodorsal surface with a series of coarse, short transverse strioles. Metatibia with longer spur longer than metatarsomere 1, spur slender. Sternum 6 with mediolateral series of punctures more oblique than in *A. punctatus*, area between punctures not modified or at most faintly flattened. Paramere (Fig. 147G) with apicoventral margin bearing a dense brush of setae; aedeagus (Fig. 147H, I) with apex strongly twisted to right, dorsal groove broadly opening to right subapically.

Female mesotibia in anterior aspect broader than male and widened apically. Metafemur with hind margin slightly arcuate, posteroapical angle slightly but distinctly produced on most specimens. Sternum 6 similar to that of male.

Comments. Attempts to find the type of *A. aeruginosus* have been unsuccessful. There are two similar species to which the name could apply. The name is applied here to the most widespread of the two, the second species is described below as new.

Ecology. This species occurs in vernal ponds. The labels on several Ontario specimens indicate they were collected "under moss [in a] dry pond bed", 5 - 6 August .

Distribution. Map 170. The species occurs in the northeastern United Sates from Massachusetts to Kansas and south to Virginia. The only Canadian specimens examined were collected in Wentworth County, Ontario, by H. Frania (ROM).



Map 170. *Agabus aeruginosus* Aubé. Canadian and Alaskan collection localities and United States state records.

Agabus xyztrus Larson, new species

Fig. 147B, J – M.

HOLOTYPE. Male, labelled: USA. N. J. [New Jersey] Atlantic Co. Apr. 8, 1984. Larson & Wolfe. Specimen deposited in USNM.

ALLOTYPE. Female, same collection data as male. Deposited in USNM.

PARATYPES. **United States**. New Jersey: same data as holotype (1 male, 2 females); Lakehurst (4 males, 10 females), CASC, USNM; Manchester (1 male, 1 female), CASC. North Carolina: Southern Pines, May 16 1917 (1 male), USNM. Virginia: Dismal Swamp, Feb. 23, 1974, J. Matta (1 female), March 2, 1974 (1 male, 6 female), J. Matta (deposited in CNC, MUN and J. Matta Collection).

Description. Length = 6.5 to 7.8 mm; width = 3.6 to 4.3 mm; length: width = 1.75 to 1.81. Similar to *A. aeruginosus* but larger on average.

Color similar to *A. aeruginosus* except infuscation of antenna and palpi less developed, palest specimens with palpi entirely yellow and antenna with only apical antennomere infuscate, most specimens with each palpus infuscate apically and apical antennomere lightly infuscate medially; gula rufous to evidently infuscate.

Elytron with meshes of sculpture small and somewhat rounded but of irregular size basally; apically with some transverse fusion of adjacent meshes and distinct tendency of meshes to form transverse series; scattered fine punctures present, subequal in size to or slightly smaller than meshes.

Metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.56 to 4.10. Metafemur clavate, length: width = 2.09 to 2.52, male femur broader than that of female, with posteroapical angle strongly produced beneath setal comb; female with projection of angle evident but smaller. Metatibial spurs long, length longer spur: length metatarsomere 1 = 1.10 to 1.32, spurs slender on both sexes, longer on male than female.

Male with protarsomeres 1 to 3 slightly dilated and each bearing a short transverse row of small oval scales beneath, protarsal ratio = 1.48 : 1.38 : 1.29 : 1.13 : 1; protarsal claws (Fig. 147B) slightly modified, anterior claw evenly arcuate and slightly broader basally than posterior. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.52. Stridulatory organ present, abdomen with suture between sterna 2 and 3 produced as a low, relatively broad carina; metafemur with anterodorsal margin bearing coarse transverse grooves. Paramere (Fig. 147J) narrow, like a curved rod with ventrolateral border bearing a small brush of setae; aedeagus (Fig. 147K – M) similar to that of *A. aeruginosus* but slenderer.

Etymology. The name is modified from the Greek xystron, meaning scraper or file, and refers to the presence of the male stridulatory organ.

Comments. The application of the name *A. aeruginosus* Aubé is uncertain as the type has not been examined. The description suits this and the preceding species equally well and the distributional data given in the original description is inadequate to help resolve the problem. The name is used here for the former more widespread species.

Ecology. Several specimens were collected in association with *A. punctatus* specimens from amongst sphagnum moss and bog myrtle at the margin of a small peatland pool in New Jersey.

Distribution. This species has a limited range along the Atlantic coast, from New Jersey to Virginia and North Carolina.

Agabus disintegratus-group
Fig. 148

Neonecticus Guignot 1951: 84, 86. Type species - *Gaurodytes disintegratus* Crotch, by original designation.

Diagnosis. Size moderate, length = 6.3 to 8.0 mm. Color basically yellow to reddish-yellow; elytron with longitudinal dark vittae. Sculpture fine, elytron with meshes small and with evident micropunctation. Clypeus with a complete narrow anterior bead; frontal

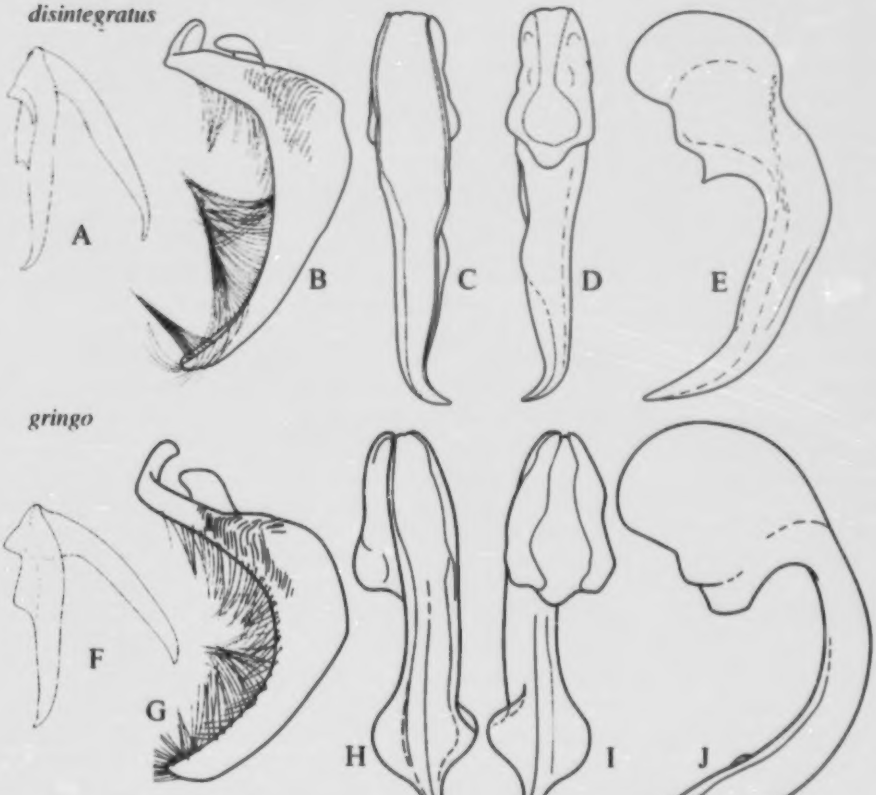

disintegratus
A
B
C
D
E
gringo
F
G
H
I
J
taeniolatus
K
L
M
N
O
A,F,K 0.2 mm
0.5 mm

Fig. 148. *Agabus disintegratus*-group. A – E - *A. disintegratus*. A - male protarsal claws, anterior. B - paramere. C - aedeagus, dorsal. D - aedeagus, ventral. E - aedeagus, lateral. F – J - *A. gringo*. F - male protarsal claws, anterior. G - paramere. H - aedeagus, dorsal. I - aedeagus, ventral. J - aedeagus, lateral. K – O - *A. taeniolatus*. K - male protarsal claws, anterior. L - paramere. M - aedeagus, dorsal. N - aedeagus, ventral. O - aedeagus, lateral.

punctures absent. Pronotum with lateral bead about one-half width of medial antennomere, well defined and of uniform width throughout length; anterior marginal bead faint but traceable on most specimens, anterior submarginal row of punctures narrowly broken medially; basal margin shallowly bisinuate each side of middle, posterolateral angle about right angled, narrowly rounded; side in lateral aspect explanate and hiding epipleuron. Prosternum and its process subangularly convex medially; process with apex pointed but not acuminate, surface sparsely punctate and setose; lateral bead not inflated. Metasternum with anteromedial impression sharply defined but short and not attaining level of hind margin of mesocoxae. Metafemur clavate, with posteroventral margin produced as a broad lamella; posteroapical comb poorly defined, most specimens with setae widely separated and arranged in a longitudinal series; without strioles. Metatibia lacking row of punctures along posteroventral margin, mesal face with coarse punctation reduced but with sparse micropunctation; metatibial spurs long, longer spur subequal to or longer than metatarsomere 1.

Male protarsus narrowly dilated; protarsal claws elongate and relatively straight, anterior claw with a small ventral tooth (Fig. 148A, F, K). Suture between sterna 2 and 3 sharply elevated mediolaterally forming a plectrum across which fine transverse grooves of anterodorsal margin of metafemur can be drawn. Aedeagus various, without a subapical ventral spine; parameres (Fig. 148E, G, L) strongly sclerotized and strap-like.

Comments. The members of this group possess a stridulatory organ. This organ is similar to that of members of the *A. aeruginosus* group but the ridge is sharper and the file of the femur much finer (Larson and Pritchard 1974). These beetles occur in temporary open ponds, often where vegetation is sparse. The vittate pattern of the elytron is disruptive and probably provides protection from predators in such open habitats.

54. *Agabus disintegratus* (Crotch 1873)

Fig. 148A – E

Gaurodytes disintegratus Crotch 1873: 416. LECTOTYPE , here designated, female in MCZC labelled: pink disc (middle states - e.g., New York, Pennsylvania)/ 3348/ Type 6051/ disintegratus Typ. Crotch.

Selected References. Fall 1922: 19; Hilsenhoff 1993*c*: 184.

Description. Length 6.3 to 8.0 mm; width = 3.3 to 4.1 mm; length: width = 1.78 to 1.96. Body oval with point of maximum width near middle; pronotum and elytra with lateral margin more or less continuous.

Head reddish with a posteromedial piceous spot, ventral surface pale except gula piceous; palpi and antenna yellow, lightly infuscate apically. Pronotum reddish yellow with anterior and posterior margins piceous to black, some specimens with these dark areas expanded and contiguous medially on disc. Elytron pale yellow with black vittate markings as follows: sutural and apical margins, three or four longitudinal discal vittae and a variously developed sublateral vitta on apical half; vitta 1 generally well developed and sharply delimited, vitta 2 of many specimens broken near base and longitudinally split in basomedial region, vitta 3 irregularly developed on most specimens with lateral margin giving off spots of various lengths near middle and subapically, some specimens with vittae broadened and variously fused so that much of disc is dark; dark areas, especially on pronotum, of most specimens with a faint greenish sheen. Ventral surface reddish except pterothorax black (pale on teneral specimens), abdomen darkened somewhat mediolaterally. Legs red.

Sculpture fine, fixed punctures distinct. Elytron with meshes small, of irregular polygonal shape basally, apically average size smaller and many with longest axis transverse. Many intersections of lines with a small puncture but punctures often obscured by depth of lines. Meshes smooth. Metacoxal plate with coarse, irregular sculpture.

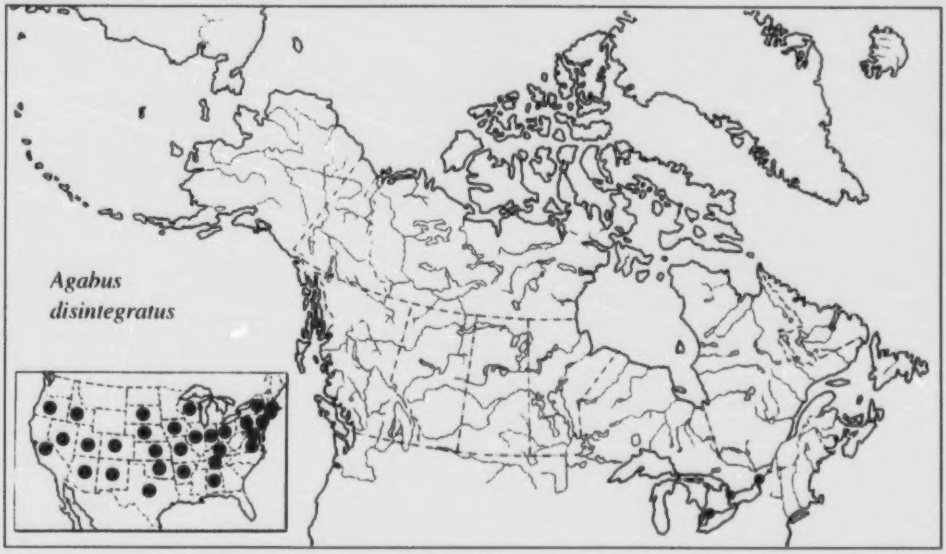
Metasternal wings broad, width of metacoxa: width of metasternal wing = 2.23 to 3.09. Metatrochanter not modified. Metafemur length: width = 2.45 to 2.90, posteroapical comb extended proximally as a line of widely separated setae. Metatibial spurs long, length longer spur: length metatarsomere 1 = 0.95 to 1.24.

Male protarsus narrowly dilated, protarsal ratio = 1.75: 1.65: 1.40: 1.12: 1; protarsomeres 1 to 3 ventrally with small oval adhesive scales, scales largest medially; protarsal claws (Fig. 148A) elongate and relatively straight, anterior claw with a small ventral tooth. Mesotarsomere 1 not greatly enlarged, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.42 to 0.50. Sternum 6 with a loose group of setiferous punctures each side of middle. Aedeagus (Fig. 148C – E) short, basal apodemes large, apex curved to right, without subapical spine; parameres (Fig. 148E) broad basally, evenly narrowing apically.

Comments. This widely distributed species varies considerably in size and in width of the metasternal wing. Size variation is mainly individual although there does appear to be more variation in western populations than in the east. This may be related to higher levels of habitat instability in the drier west which subject the larvae to more varied conditions. Larson (1994) noted that *Agabus* species in more extreme environments tend to show relatively high levels of intraspecific variation in body size. The width of the metasternal wing varies geographically with populations from California having values for width of metacoxa: width of metasternal wing = 2.55 to 3.09, whereas vales over the rest of the range are 2.18 to 2.79 with no additional geographic pattern within this region. This pattern of variation may be discrete enough to merit the recognition of subspecies but at this time it has not been adequately investigated.

Ecology. This is a species of temporary ponds. Garcia and Hagen (1985, 1987) and Garcia *et al*. (1990) studied the ecology of this species in temporary ponds in the Central Valley of California. In this latitude the beetles pass the dry summer dry period in a state of diapause and become active and reproduce in the fall when the ponds refill with water. In Wisconsin, Hilsenhoff (1993*c*) collected most adults and larvae during the period late March to late June. Apparently overwintering adults lay eggs in the spring which hatch and complete development into adults by early summer. These adults probably aestivate over the summer and become active in the fall and again in the spring when the pools are full. Holomuzki (1985*a*) showed a diel activity pattern amongst adults of this species, with most activity occurring at night in vegetated shallows.

Distribution. Map 171. The species is transcontinental in the United States but in Canada occurs only in the southern portions of Ontario.



Map 171. *Agabus disintegratus* (Crotch). Canadian and Alaskan collection localities and United States state records.

55. *Agabus gringo* Larson, new species

Fig. 148F – J

HOLOTYPE. Male, labelled: MEXICO, Durango, Reserva de la Biosfera, La Michilia ca. 23° 24' N 104° 12' W/ Mesa del Burro, Laguna del Burro, 2700 m, dry pond 80-39, August 18, 1980/ MEX. EPED. 1980 G.E. Ball, W. Fragat, D. Shpeley collectors. Deposited in USNM.

ALLOTYPE. Female, same collection data as holotype. Deposited in USNM.

PARATYPES. Same collection data as holotype. (10 males, 5 females). Deposited in CASC, CNC, MUN.

Description. Length 6.8 to 7.8 mm; width = 3.6 to 4.1 mm; length: width = 1.84 to 2.00. Body elongate-oval, narrower and more parallel-sided than *A. disintegratus*; pronotum and elytra with lateral margin continuous.

Head reddish-yellow with a small posteromedial piceous spot, ventral surface including gula pale; palpi and antenna yellow, infuscate apically. Pronotum red, anterior margin with a diffuse submarginal darkened area, hind margin broadly translucent and darkened from overlying elytral base. Elytron reddish-yellow with black vittate markings as follows: sutural and apical margins, three longitudinal discal vittae and a variously developed sublateral vitta on apical half, vitta 1 generally complete, vitta 2 of many specimens longitudinally split over a portion of its length, vitta 3 narrower with lateral margin giving off narrow stripes of various lengths near middle and subapically, dark areas without a greenish sheen. Ventral surface and legs reddish.

Sculpture very fine, body shiny and fixed punctures conspicuous. Elytron with lines of sculpture very fine, partly effaced basally on some specimens, meshes small and more or less isodiametric; fine punctures of varied size present over disc. Metacoxal plate with granular sculpture and irregular, transverse rugae.

Metasternal wings narrower than in *A. disintegratus*, width of metacoxa: width of metasternal wing = 2.96 to 3.50. Metatrochanter not modified. Metafemur clavate, femur length: width = 2.45 to 2.78, with a broad posterior lamina; setae of posteroapical comb irregular, extended proximally as a line of widely separated setae. Metatibial spurs long, length longest spur: length metatarsomere 1 = 1.00 to 1.2.

Male protarsus narrowly dilated, protarsal ratio = 1.78: 1.68: 1.42: 1.24: 1; protarsomeres 1 to 3 with small narrowly oval scales beneath; protarsal claws (Fig. 148F) elongate, anterior with a small ventral tooth. Mesotarsomere 1 stout but not elongate; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.42 to 0.46. Sternum 6 with a loose group of setiferous punctures each side of middle. Aedeagus (Fig. 148H – J) short, basal piece large, subapically with broad lateral flanges; paramere (Fig. 148G) crescentic, relatively broad.

Etymology. A gringo is a foreigner, especially an American, in a Spanish-speaking country. The name is apt for this species as it is the northern Mexican representative of a primarily United States group.

Comments. Sharp's (1882*b)* reference to *A. disintegratus* in Mexico probably applies to this species.

Ecology. The habitat is not known. However, the collection note "dry pond" suggests the species, like *A. disintegratus*, occurs in seasonal ponds.

Distribution. The only known locality is the type locality in Durango, Mexico. Sharp's (1882) record of *A. disintegratus* from Mexico may refer to this species.

56. *Agabus taeniolatus* (Harris 1828)

Fig. 148K – O

Colymbetes taeniolatus Harris 1828*b*: 164. LECTOTYPE, here designated, male in Harris Collection, MCZC, labelled: 223/ 466/ Lectotype *Colymbetes taeniolatus* Harris des. D. Larson 1984.

Selected Reference. Fall 1922: 19.

Description. Length 6.7 to 7.5 mm, width 3.8 to 4.3 mm, length: width = 1.69 to 1.81. Similar in size and habitus to *A. disintegratus* but averaging slightly larger and slightly broader in outline.

Head reddish-yellow with piceous spots posteromedially between eyes and along hind margin; ventral surface including gula pale; antenna and palpi yellow basally, suffused with brown and infuscate apically. Pronotum reddish-yellow medially and laterally, anterior margin along medial emargination and hind margin medially broadly dark brown to piceous, these darkened areas narrowly longitudinally confluent medially on disc of some specimens. Elytron yellow with dark markings as follows: base near suture, sutural margin and lateral margin at apex, and disc with three broad longitudinal vittae and a small sublateral vitta in apical half; vittae 1 and 2 entire, vitta 3 with lateral anterior projections near middle and subapically; many specimens with vittae confluent at apex and base, or some with vitta 2 broken or constricted subbasally but not longitudinally divided. Ventral surface and legs pale rufous.

Elytron with lines fine, forming small meshes of unequal size and irregular shape; many meshes transversely stretched, especially apically; small punctures evident. Metacoxal plate with fine reticulation superimposed on coarse, irregular rugae.

Metasternal wing relatively narrow, width of metacoxa: width metasternal wing = 2.84 to 3.57. Metatrochanter with hind margin sharply carinate basally. Metafemur with setae of posteroapical comb widely spaced in a longitudinal row; metafemur length: width = 2.61 to 2.89. Metatibia with ventral mesal margin impunctate except at most with a few punctures along basal third; ventral face with evident micropunctation. Metatibial spurs long, length longer spur: length metatarsomere 1 = 0.97 to 1.22.

Male protarsal ratio = 1.76 : 1.46 : 1.28 : 1.10 : 1; protarsomere 1 with a flat lobe on posteroventral margin, apex of protarsomere 1 and protarsomeres 2 and 3 with a small number of oval adhesive setae; anterior protarsal claw (Fig. 148K) with ventral tooth more basal in position than that of *A. disintegratus*. Mesotibia with inner margin broadly emarginate; spurs elongate, longer spur slightly shorter than mesotarsomere 1; mesotarsomere 1 elongate, laterally flattened, broadly ridged ventrally and with adhesive scales restricted to apex; length mesotarsomere 5: combined length mesotarsomeres 1 to 4 = 0.27 to 0.31. Sternum 6 lightly longitudinally rugose and punctate medially. Aedeagus (Fig. 148M – O) elongate, spoon-shaped in dorsal aspect, narrow basally, flat and broadened subapically with apex bluntly pointed and curved to right; paramere (Fig. 148L) narrow, strap-like, strongly bent medially.

Ecology. Specimens have been collected from a barren, clay and sand bottomed, artificial pond in New Jersey. In April the pond was full of water but it could have been temporary.

Distribution. This species is known only from the central Atlantic seaboard of the United States.

Agabus affinis-group
Fig. 149

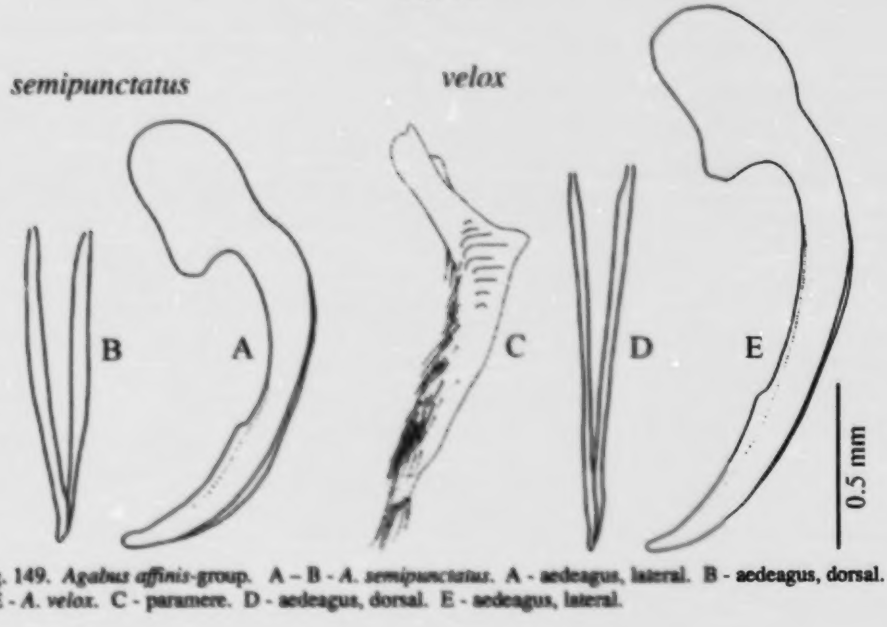


Fig. 149. *Agabus affinis*-group. A – B - *A. semipunctatus*. A - aedeagus, lateral. B - aedeagus, dorsal. C – E - *A. velox*. C - paramere. D - aedeagus, dorsal. E - aedeagus, lateral.

Diagnosis (North American species). Size small, length = 5.8 to 7.0 mm. Shape elongate-oval, lateral margin more or less continuous. Body mainly black, elytron with a postmedial and a subapical pale spot. Sculpture of elytron consisting of small, isodiametric to irregular meshes, without microreticulation on meshes, lines and intersections with small punctures. Clypeal bead more or less continuous. Pronotum with anterior submarginal row of punctures continuous. Prosternal process short, lateral bead not expanded; metasternum with anteromedial impression short. Male anterior protarsal claw with a ventral tooth. Aedeagus (Fig. 149A, B, D, E) without a subapical ventral spine but with a longitudinal ventral ridge; basal apodemes large. Paramere (Fig. 149C) stylate. Males with a stridulatory organ composed of with sternum 3 bearing a curved sublateral series of ridges across which a ridge on anterodorsal margin of metafemur can be drawn.

Comments. This was referred to as the *A. semipunctatus*-group by Larson (1989) but the *affinis*- group (Zimmermann1934) has a similar concept and a long history of use and is therefore a more appropriate name. This group contains seven Palaearctic and two Nearctic species, with no species common to both regions (Nilsson and Larson 1990; Nilsson 1994*c*). Most species occur in the boreal or low arctic zones where they occupy permanent, vegetation-rich lentic habitats. The life cycle is univoltine with adults overwintering and breeding in the spring and larvae developing in summer (Nilsson 1986*a*).

57. *Agabus semipunctatus* (Kirby 1837)

Fig. 148.

Colymbetes semipunctatus Kirby 1837: 69. Holotype - male in BMNH labelled: Type H.T.; N. Amer.

Selected References. Larson 1975: 341 – 342, Nilsson and Larson 1990: 231 – 233, Hilsenhoff 1993*c*: 188; Larson 1997*b*: 510.

Description. Length = 5.8 to 6.8 mm; width = 3.0 to 3.4 mm; length: width = 1.88 to 2.00. Small, elongate-oval species.

Body mainly black. Head with frontal spots and labrum rufous; antenna pale basally, outer antennomeres beginning at 4 or 5 infuscate, antennomere 11 piceous apically; palpi rufous with apical palpomere of each palpus infuscate. Pronotum and also elytra of some specimens with lateral margin piceous. Elytron with a medial sublateral and an apical pale spot (on many specimens spots visible only when elytron is lifted). Ventral surface piceous to black. Legs mainly piceous.

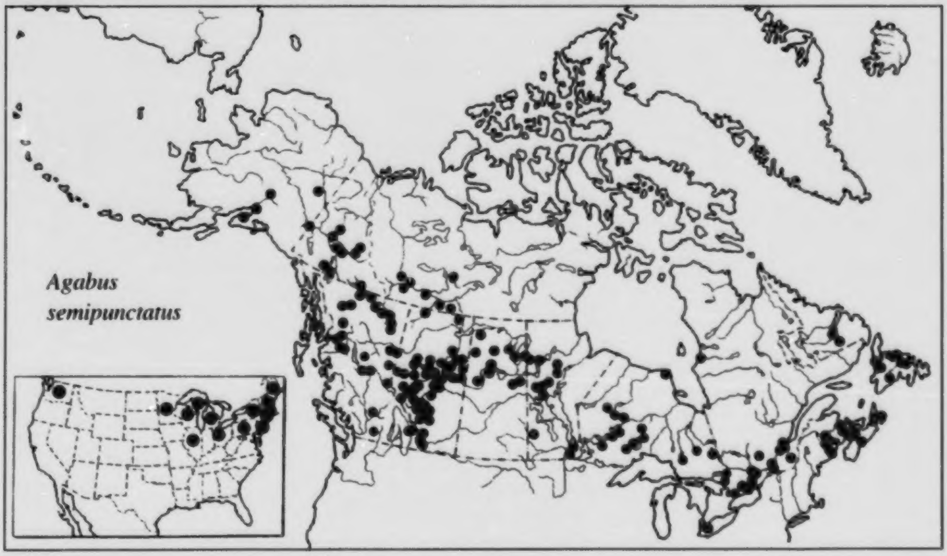
Elytron with sculpture fine, meshes irregular in size and shape basomedially, laterally and apically finer, more or less rounded and of similar size but interspersed with some larger more rectangular meshes; some intersections of lines with small punctures.

Clypeus with anterior bead complete or irregularly and narrowly broken. Pronotum with lateral bead of moderate width, gradually narrowing to anterolateral angle. Prosternal process strongly but smoothly convex in cross section. Metasternum with anteromedial emargination short, not extended to level of hind margin of mesocoxae; metasternal wing relatively narrow, width of metacoxa: width metasternal wing = 2.27 to 2.65. Metatibia with punctures along posteroventral margins, their extent various from basal half to more or less entire length; ventral face without punctation. Metatibial spur slightly shorter than metatarsomere 1, length longer spur: length metatarsomere 1 = 0.82 to 0.97.

Male protarsomeres 1 to 3 narrowly dilated; width protarsomere 1 = 0.11 to 0.13 mm; protarsal ratio = 1.78: 1.60: 1.34: 1.16: 1; anterior protarsal claw with a large ventral tooth. Length mesotarsomere 5: combined length mesotarsomeres 1 to 4 = 0.45 to 0.48. Sternum 3 laterally with an arch of closely spaced raised ridges. Aedeagus (Fig. 149A, B) in lateral aspect with a medioventral projection and ridge extending along right lateral margin from projection to apex.

Ecology. This species often occurs in *Sphagnum* bogs but is not restricted to such habitat as specimens have also been collected regularly from *Carex*-choked waters. Hilsenhoff (1993) suggests adults overwinter in terrestrial sites.

Distribution. Map 172. The range is transcontinental in the boreal zone.



Map 172. *Agabus semipunctatus* (Kirby). Canadian and Alaskan collection localities and United States state records.

58. *Agabus velox* Leech 1939

Fig. 149C – E

Agabus velox Leech 1939: 219. Type locality - Churchill, Manitoba. Type in CNC.

Selected References. Nilsson and Larson 1990: 234 – 235; Larson 1997*b*: 511.

Description. Length = 6.1 to 7.0 mm; width = 3.0 to 3.4 mm; length: width = 1.98 to 2.09. Similar to *A. semipunctatus*, but slightly larger and more elongate on average.

Color similar to *A. semipunctatus*. Elytron with a sublateral postmedial pale spot.

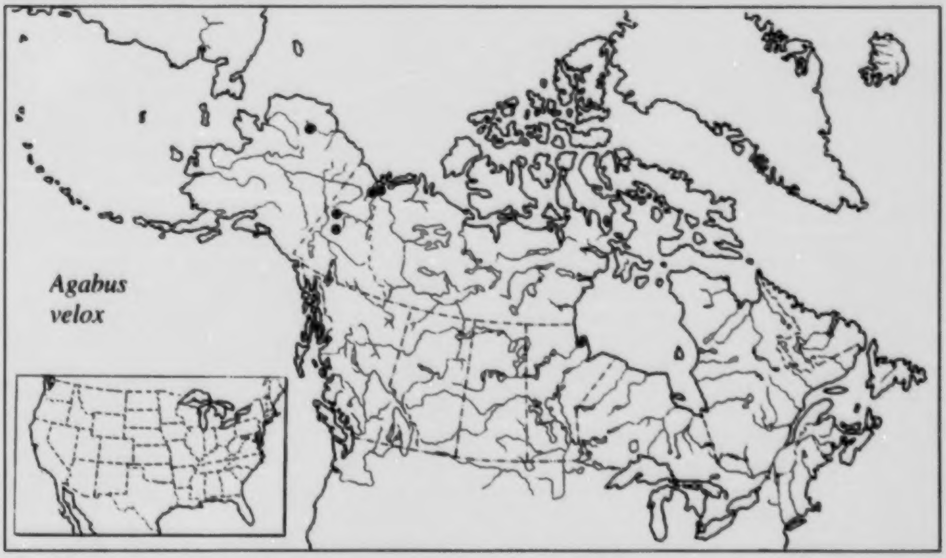
Elytron with sculpture coarser and more irregular than that of *A. semipunctatus*; meshes irregular in size and shape, larger meshes subequal in size to diameter of serial punctures; lines more deeply impressed on most females. Some intersections with distinct punctures.

Prosternal process strongly convex to subangular in cross section. Metasternal wing relatively broad, width of metacoxa: width metasternal wing = 2.20 to 2.56. Metatibia with posteroventral row of punctures more or less complete. Metatibial spurs subequal in length to metatarsomere 1, length longer spur: length metatarsomere 1 = 0.97 to 1.00.

Male pro- and mesotarsomeres relatively broadly dilated, width protarsomere 1 = 0.18 to 0.21 mm; protarsal ratio = 2.20: 2.25: 1.71: 1.15: 1; anterior protarsal claw with an acute ventral tooth near base. Length mesotarsomere 5: combined length mesotarsomeres 1 to 4 = 0.50 to 0.55. Male sternum 3 with a slightly tumid area on each side which bears a number of subparallel, curved lines but surface not raised into evident ridges. Aedeagus (Fig. 149D, E) elongate, with a medioventral projection, ventral ridge evident from base to apex.

Ecology. The habitat is apparently similar to that of *A. semipunctatus* for specimens have been collected from the edges of pools in bogs and fens.

Distribution. Map 173. This species occurs in the low arctic region from Hudson Bay west to northern Alaska.



Map 173. *Agabus velox* Leech. Canadian and Alaskan collection localities and United States state records.

Agabus punctulatus-group
Fig. 150

Diagnosis. Small species, length = 5.5 to 6.5 mm; body ovate, lateral margins of pronotum and elytra continuous or slightly discontinuous. Color pale yellow brown to piceous, most specimens with at least a faint metallic green sheen. Sculpture of male

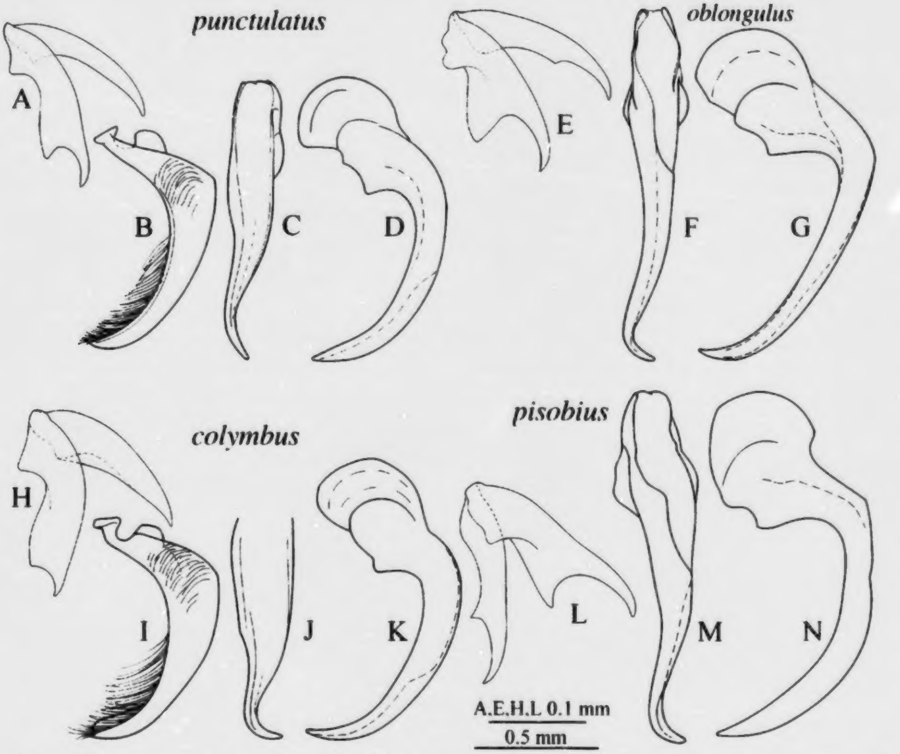


Fig. 150. *Agabus punctulatus*-group. A – D - *A. punctulatus*. A.- male protarsal claws, anterior. B - paramere. C - aedeagus, dorsal. D - aedeagus, lateral. E – G - *A. oblongulus*. E.- male protarsal claws, anterior. F - aedeagus, dorsal. G - aedeagus, lateral. H – K - *A. colymbus*. H.- male protarsal claws, anterior. I - paramere. J - aedeagus, dorsal. K - aedeagus, lateral. L – N - *A. pisobius*. L - male protarsal claws, anterior. M - aedeagus dorsal. N - aedeagus lateral.

consisting of very irregular meshes, with punctures present at many intersections of lines; female either like male or with dense microreticulation making surface matte. Metafemur lacking strioles. Clypeus with anterior bead complete; frontal punctures absent. Pronotum with lateral bead well defined, broadest medially and narrowed onto front angles; anterior bead obsolete medially; anterior marginal series of punctures complete. Prosternum with process short, strongly convex, surface setose; lateral bead narrow. Metafemur clavate, setae of posteroapical comb extending proximally as a widely spaced row; metatibia with punctures along at least basal half of posteroventral margin; metatibial spur slightly shorter than to subequal in length to metatarsomere 1. Male anterior protarsal claw (Fig. 150A, E, H, L) with a ventral tooth. Paramere (Fig. 150B, I) strap-like, sclerotized throughout length, apical sclerite very small; aedeagus (Fig. 150D, G, K, N) with basal piece very large, shaft twisted to right in dorsal aspect and dorsal groove variously exposed.

Comments. This group contains four North American species and the Palaearctic species *A. luteaster* (Zaitzev). *Agabus luteaster* differs from North American species in that it is brown in color but lacks a metallic reflection and the aedeagus has a large basal piece but the shaft is straight and not twisted apically. The anterior protarsal claw has a broad ventral tooth and is similar in shape to that of *A. colymbus*. Three of the North American species are allopatric to one another whereas the range of the fourth, *A. pisobius*, overlaps *A. punctulatus* and *A. oblongulus*. It is only *A. pisobius* that possesses as stridulatory organ which may play a role in species segregation in areas of sympatry.

59. *Agabus punctulatus* Aubé 1838

Fig. 150A – D

Agabus punctulatus Aubé 1838*b*: 332. Type locality - “l’ Amerique du Nord”.

Gaurodytes aeneolus Crotch 1873: 417. LECTOTYPE, here designated, - male in LeConte Collection, MCZC, labelled: pink disk/ G. aeneolus Crotch, with lectotype designation.

Selected References. Leech 1949: 247, 256; Larson 1975: 345; Hilsenhoff 1993*c*: 188; Larson 1997*b*: 510.

Description. Length = 5.5 to 6.4 mm, width = 3.0 to 3.5 mm, length: width = 1.73 to 1.89. A small, oval species, outline more or less continuous, with greenish reflection to the dorsal surface.

Color of dorsal surface dark rufous to piceous or almost black in some males; most specimens with a faint to distinct aeneous sheen. Head with frontal spots and anterior margin rufous; antenna and palpi testaceous basally, infuscate apically. Pronotum with lateral margins rufous. Elytron dark rufous laterally, without pale subapical spots. Ventral surface rufous to piceous. Legs rufous.

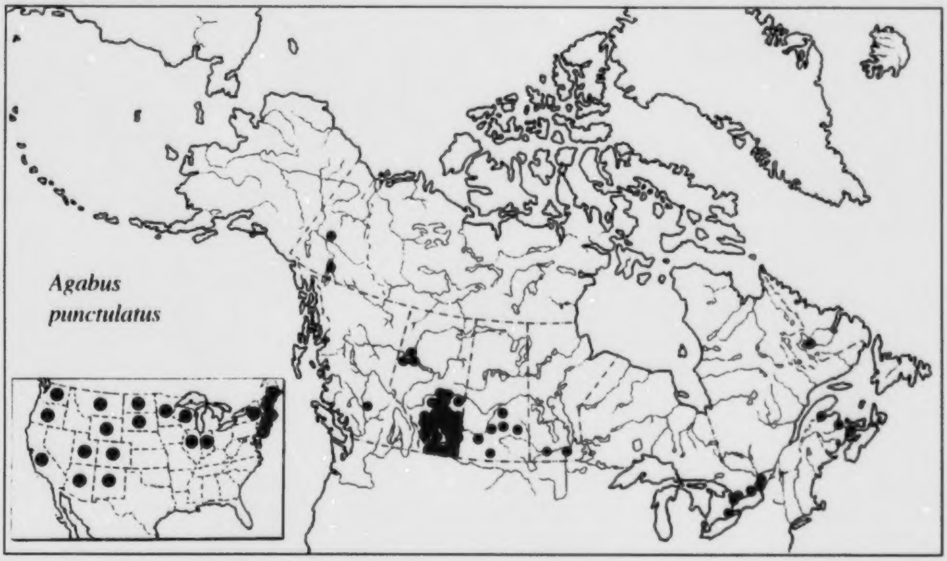
Sculpture sexually dimorphic. Male dorsally with fine lines forming meshes of irregular size and shape, lines with conspicuous punctures at many intersections, meshes smooth basally with fine punctures, some specimens with obsolete reticulation apically. Female elytron basally with at least some meshes longitudinal in orientation, most females with meshes strongly stretched, laterally and apically meshes more rounded and irregular, meshes with microreticulation on most specimens. Metacoxal plate with irregular longitudinal lines and transverse rugae, interspaces with microreticulation absent or irregular and somewhat effaced.

Pronotum with lateral bead of moderate width, complete but slightly narrowing towards anterolateral angle; posterolateral angle about right angled to slightly produced, lateral margin more or less continuous in curvature with elytron or slightly more arcuate basally. Width of metacoxa: width metasternal wing = 2.89 to 3.28. Metafemur length: width = 2.76 to 3.08; metatibia length: width = 3.79 to 4.50, with irregular row of setiferous punctures along at least basal one-half to two-thirds of posteroventral margin; ventral face with numerous small punctures, almost indiscernible on some specimens. Longer metatibial spur subequal in length to metatarsomere 1, length spur: length metatarsomere 1 = 0.88 to 1.00. Metatarsomere 1 with from 1 to 6 ventrolateral setae. Suture between abdominal sterna 2 and 3 not raised, stridulatory organ absent.

Male protarsomere 1 width = 0.14 to 0.16 mm, protarsal ratio = 2.08: 1.75:1.45:1.13:1; ventrally protarsomeres 1 to 3 with oval adhesive setae of similar size; anterior protarsal claw (Fig. 150A) with an acute, more or less distally directed ventral tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.50. Aedeagus (Fig. 150C, D) with basal piece very large; apex strongly twisted to right, dorsal groove open for entire length in dorsal aspect and not covered near middle by extension of left side.

Ecology. The most typical habitat is flooded grasses along the margin of vernal ponds in open, grassland areas.

Distribution. Map 174. The range is wide extending from the Atlantic coast almost to the Pacific in southern Canada and northern United States. The latitudinal range is narrower in the east than in the west for in the west the species occurs from central Alaska and Yukon Territory to northern New Mexico and Arizona. Populations in grassland regions of the Yukon River Valley and the Peace River area of Alberta appear to be isolated.



Map 174. *Agabus punctulatus* Aubé. Canadian and Alaskan collection localities and United States state records.

60. *Agabus colymbus* Leech 1938

Fig. 150H – K

Agabus colymbus Leech 1938: 125 – 126. Type locality - Churchill, Manitoba. Type in CNC.

Selected Reference. Larson 1997*b*: 508 (in error, see distribution below).

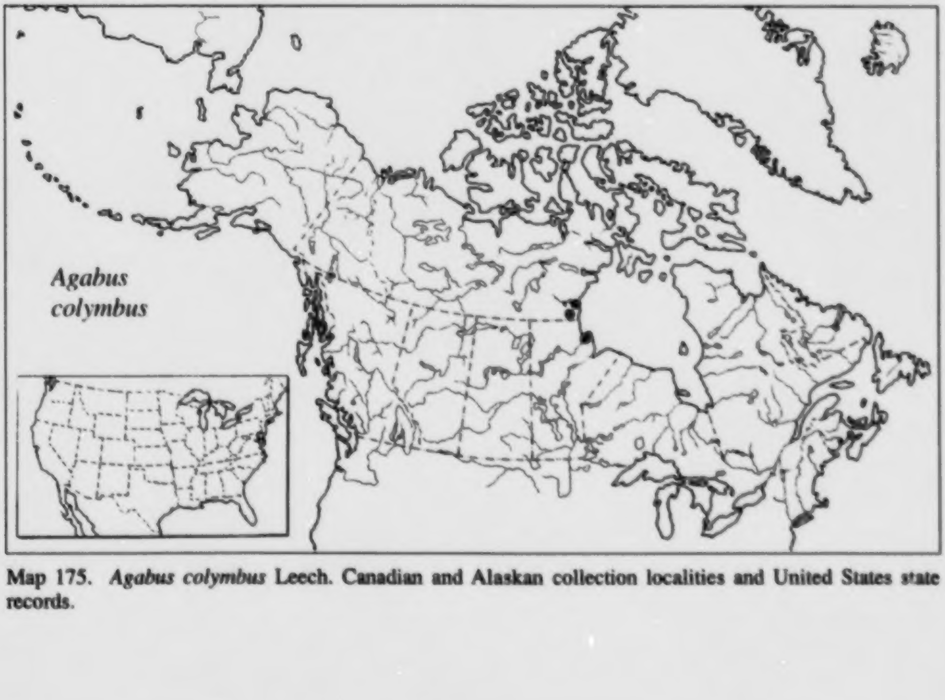
Description. Length = 5.5 to 6.5 mm, width = 3.0 to 3.5 mm, length: width = 1.73 to 1.95. A small, oval species of slightly discontinuous outline, dorsal surface with a greenish reflection.

Color of dorsal surface pale to dark reddish brown or piceous; most specimens with a faint aeneous sheen. Head dark brown to piceous medially and posteriorly, frontal spots and anterior margin pale brown; antenna and palpi testaceous basally, infuscate apically. Pronotum with a diffuse, transverse dark area on disc. Elytron pale laterally, darker reddish brown medially. Ventral surface and legs pale reddish brown to ruff-piceous.

Sculpture sexually dimorphic. Male elytron with meshes of very irregular size and shape, punctures of varied size at many intersections, meshes smooth. Female elytron dull, basally with meshes small and longitudinal in orientation, laterally and apically meshes smaller and more rounded, meshes strongly microreticulate. Metacoxal plate with coarse irregular lines, interspaces microreticulate.

Pronotum with lateral bead of moderate width, strongly but evenly narrowed on anterolateral angle; posterolateral angle slightly rounded and obtuse, lateral margin curved towards base and discontinuous in outline with elytron. Prosternum and its process more or less in same plane, strongly convex with process more smoothly rounded, punctate and setose, process bluntly pointed apically. Metasternum with anteromedial process narrow, impression short and not reaching level of hind margin of mesocoxae; width of metacoxa: width metasternal wing = 2.95 to 3.50. Metafemur length: width = 2.69 to 3.04. Metatibia length: width = 4.00 to 4.61; metatibia with setiferous punctures along most of posteroventral margin; ventral face with punctures on basal half, distal half with minute micropunctures on some specimens. Longer metatibial spur shorter than metatarsomere 1, length spur: length metatarsomere 1 = 0.76 to 0.91. Metatarsomere 1 with from 1 to 6 ventrolateral setae. Suture between abdominal sterna 2 and 3 not raised, stridulatory organ absent.

Male protarsus relatively broadly dilated, width protarsomere 1 = 0.22 to 0.27 mm, protarsal ratio = 2.75: 2.09: 1.65: 1.10: 1; protarsomeres 1 to 3 ventrally with dense, small adhesive setae basally and larger oval setae apically; anterior protarsal claw (Fig. 150H) with a broad ventral shelf with apical angle right angled to obtuse and not projecting as an evident tooth, apical point of claw may or may not be prominent. Mesotarsomere 1 elongate and broad, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.49 to 0.56. Aedeagus (Fig. 150J, K) with basal piece very large; apex strongly twisted to right, dorsal groove visible in dorsal aspect for entire length.



Map 175. *Agabus colymbus* Leech. Canadian and Alaskan collection localities and United States state records.

Ecology - The habitat has not been described.

Distribution. Map 175. This species is known from a very restricted area along the west side of Hudson Bay. Records from the Yukon Territory (Larson 1997) were based on misidentified female specimens of *A. punctulatus*.

61. *Agabus oblongulus* Fall 1922

Fig. 150E – G

Agabus oblongulus Fall 1922: 18. Type locality - Corvallis, Oregon. Type - in MCZC, male, no. 23974, examined.

Selected References. Leech 1949: 247–248, 256.

Description. Length = 5.5 to 6.4 mm, width = 2.9 to 3.5 mm, length: width = 1.88 to 2.00. Very similar to *A. punctulatus* but body slightly more elongate.

Color of dorsal surface dark rufous to piceous, most specimens with a faint aeneous to cupreous sheen. Head piceous with frontal spots and anterior margin rufous; antenna and palpi testaceous basally, infuscate apically. Pronotum piceous with lateral margins rufous. Elytron pale brown laterally, darker reddish brown on disc. Ventral surface rufous to piceous. Legs rufous, femora infuscate basally.

Sculpture sexually dimorphic. Male elytron with meshes of irregular size and shape, conspicuous punctures present at many intersections of lines, meshes smooth. Female elytron basally and medially with meshes longitudinal, laterally and apically meshes more rounded and irregular, meshes with microreticulation.

Pronotum with lateral bead narrow, slightly narrowing towards anterolateral angle; lateral margin more or less continuous in outline with elytron; hind angle about right angled. Prosternal process strongly convex medially, sharply pointed, sparsely setose. Metasternum with anteromedial impression not or scarcely reaching level of hind margin of mesocoxal cavity; width of metacoxa: width metasternal wing = 2.41 to 3.38. Metafemur length: width = 2.60 to 2.92; metatibia length: width = 3.68 to 4.22, metatibia with an irregular row of setiferous punctures along at least basal one-half to two-thirds of posteroventral margin; ventral face with small punctures at base, otherwise smooth to faintly micropunctate. Length of longer metatibial spur: length to metatarsomere 1 = 0.81 to 1.00. Suture between abdominal sterna 2 and 3 not raised, stridulatory organ absent.

Male protarsus narrowly dilated, width protarsomere 1 = 0.14 to 0.16 mm, protarsal ratio = 2.03: 1.81: 1.50: 1.13: 1; protarsomeres 1 to 3 ventrally with small adhesive setae of similar size; anterior protarsal claw (Fig. 150E) with a large subbasal tooth, apex of tooth directed at an angle away from longitudinal axis of claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.49 to 0.54. Aedeagus (Fig. 150F, G) with dorsal groove twisted to right and hidden in dorsal aspect for much of its length, in lateral aspect shaft slender and strongly bent basally.

Ecology. The species occurs in pools and ponds, generally along shorelines rich in emergent vegetation and plant debris. Specimens have been found in snow-melt pools and like *A. punctulatus* may be typically an inhabitant of vernal or temporary freshwater ponds.

Distribution. This species occurs in Washington and Oregon.

62. *Agabus pisobius* Leech 1949

Fig. 150L – N

Agabus pisobius Leech 1949: 246. Type locality - Creston, B.C. Type in CASC.

Selected Reference. Larson 1975: 346.

Description. Length = 5.6 to 6.5 mm, width = 2.9 to 3.5 mm, length: width = 1.86 to 2.05. Body relatively elongate, dorsal outline continuous, color dark and many specimens with an aeneous sheen.

Color dark reddish brown to black, dorsal surface of most specimens faintly aeneous. Head piceous to black with anterior margin and frontal spots rufous; antenna and palpi rufous, infuscate apically. Pronotum piceous to black with lateral margin rufous; elytron piceous, paler laterally, with a small subapical pale spot (on some specimens may be visible only when elytron is lifted). Ventral surface rufous to piceous. Legs rufous.

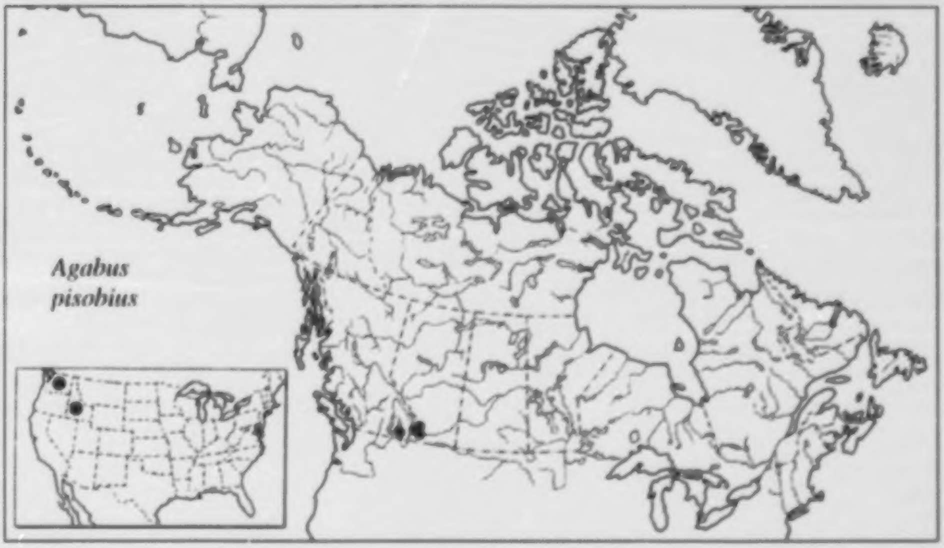
Sculpture similar on both sexes. Elytron with meshes of irregular size and shape, without definite orientation or on some females with a slight tendency for longitudinal arrangement basally; punctures present at many intersections of lines; meshes smooth without microreticulation or at most with reticulation suggested towards apex.

Pronotum with lateral bead narrow, about one-half width of apex of antennomere 3, slightly and evenly narrowed towards anterior angle; lateral margin more or less continuous in outline with elytron, posterolateral angle about right angled to slightly produced. Prosternum and its process with more or less angulate medial convexity, process narrow and sharply pointed, sparsely setose laterally. Width of metacoxa: width metasternal wing = 2.90 to 3.34. Metafemur very broad, length: width = 2.38 to 2.71, with posteroapical angle somewhat produced; anterodorsal margin with transverse ridges. Metatibia length: width = 3.89 to 4.35; posteroventral series of punctures extending to at least middle, on many specimens almost reaching apex, ventral surface punctate at base otherwise smooth or with sparse micropunctures. Abdomen of both sexes with suture between sternites 2 and 3 raised laterally into a low sharp ridge across which ridges of metafemur can be drawn, forming a stridulatory organ.

Male protarsomeres 1 to 3 narrow, width protarsomere 1 = 0.13 to 0.14 mm, protarsal ratio = 1.79: 1.65: 1.42: 1.16: 1; protarsomeres 1 to 3 with small oval adhesive setae beneath; anterior protarsal claw (Fig. 150L) with ventral tooth located more basally than that of *A. punctulatus*, apex of tooth directed at an angle away from longitudinal axis of claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.44 to 0.49. Aedeagus (Fig. 150M, N) with basal piece large, apex strongly twisted to right, ventral groove covered dorsally near middle by extension of left side.

Ecology. These insects occur among emergent plants at the margins of small ponds situated either in grassland or in low elevation montane forest. Several collections have been from beaver ponds. Teneral specimens have been collected in the first half of July.

Distribution. Map 176. This is a western species that occurs in southwestern Alberta, southern British Columbia and the northwestern states of Idaho and eastern Washington.



Map 176. *Agabus pisobius* Leech. Canadian and Alaskan collection localities and United States state records.

Agabus uliginosus-group
Fig. 151

Diagnosis. Small to medium sized species, length = 5.3 to 7.6 mm; body short and ovate to elongate; lateral margins of pronotum and elytra continuous or slightly discontinuous. Color brown to black. Sculpture consisting of meshes of varied size and shape, with punctures present at many intersections of lines. Metafemur lacking strioles. Clypeus with anterior bead complete; frontal punctures absent. Pronotum with lateral bead broad; anterior bead obsolete medially; anterior submarginal series of punctures complete or narrowly broken. Prosternum with process strongly convex in cross section, sparsely to densely setose. Metasternum with anteromedial process narrow, impression short and not or barely reaching level of hind margin of mesocoxal cavities. Males of some species with a stridulatory organ consisting of a raised ridge between abdominal sterna 1 and 2 and a file on anterodorsal margin of metafemur. Male anterior protarsal claw (Fig. 151A, H) modified, either with a ventral tooth or broadened ventrally. Paramere (Fig. 151B, G, I) with basal sclerite elongate and narrow, strap-like; aedeagus (Fig. 151D, F, L) with basal piece very large, shaft straight or twisted to right in dorsal aspect. Female gonocoxae triangular and laterally flattened.

Comments. The members of this group share several characters with members of the *disintegratus*-, *punctulatus*-, *affinis*- and *aeruginosus*-groups and these groups are clearly related. For example males of some species within each of these groups possess a stridulatory organ formed from the metafemur rubbing across a basolateral portion of the abdomen (Larson and Pritchard 1974). In the *affinis*-group, the file is on the abdomen and the plectrum on the femur whereas in all other species the plectrum is on the abdomen and the file on the metafemur. This type of organ does not occur in any other section of *Agabus*. Other similarities, although not consistent within all groups, include punctate intersections of lines on elytral sculpture, toothed anterior male protarsal claw, aedeagus with large basal apodemes and strap-like parameres.

The *uliginosus*-group is Holarctic although no species is Holarctic. Three species occur in the Nearctic region. We do not know how many Palaearctic species belong to the group, but aside from *A. uliginosus* (Linnaeus) the peculiar Siberian species *A. lineatus* Gebler (elytra vittate) and *A. vereschaginae* Angus (male with clubbed antennae) are members.

These beetles occur in vernal ponds, among flooded grasses and sedges. They seem to have rather narrow habitat requirements for they tend to be poorly collected and very locally distributed.

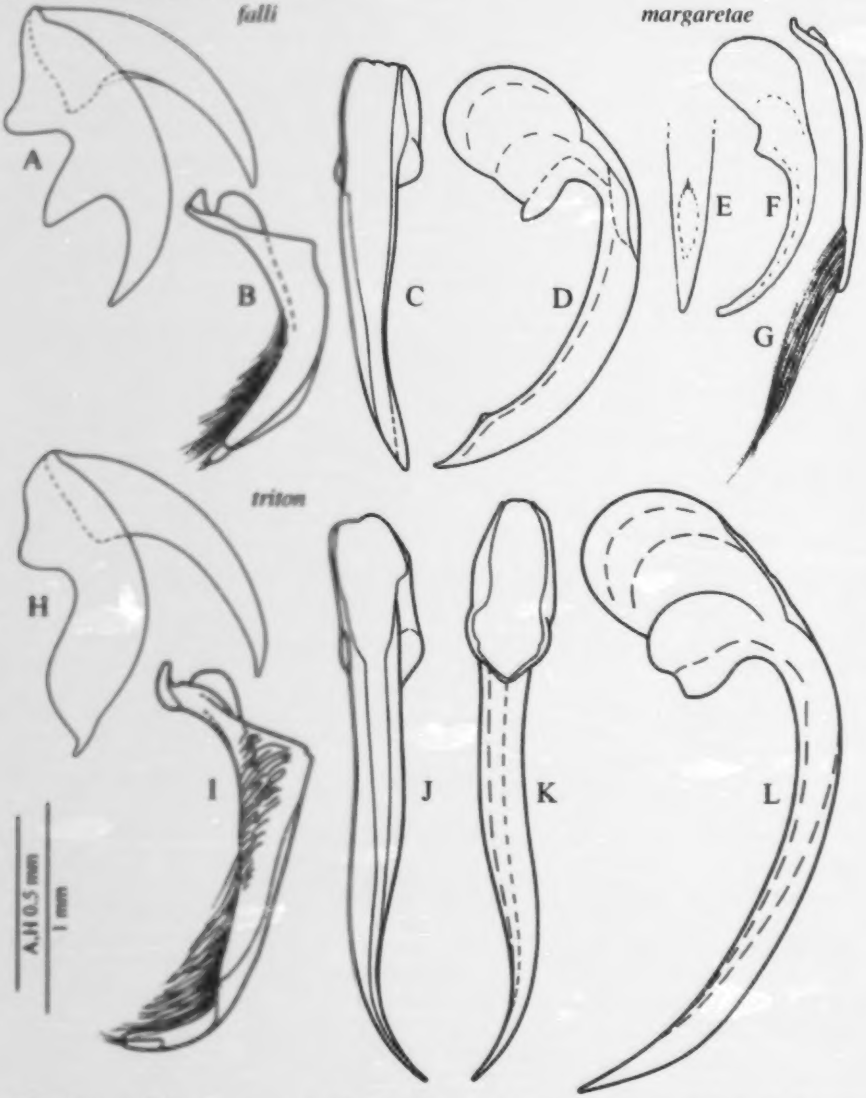


Fig. 151. *Agabus uliginosus*-group. A – D - *A. falli*. A - male protarsal claws, anterior. B - paramere. C - aedeagus, dorsal. D - aedeagus, lateral. E – G - *A. margaretae*. E - aedeagus, dorsal. F - aedeagus, lateral. G - paramere. H – L - *A. triton*. H - male protarsal claws, anterior. I - paramere. J - aedeagus, dorsal. K - aedeagus, ventral. L - aedeagus, lateral.

63. *Agabus falli* (Zimmermann 1934)

Fig. 151A – C

Agabus semipunctatus; Sharp 1882*a*: 507, not Kirby 1837.

Agabus sharpi Fall 1922: 19. Type locality - Winnipeg, Manitoba. Type - MCZC, male, no. 23976, examined [not Jakobs 1908].

Gaurodytes falli Zimmermann 1934: 186. New name for *Agabus sharpi* Fall.

Selected References. Larson 1975: 342–343; Hilsenhoff 1993*c*: 185.

Description. Length = 6.5 to 7.6 mm; width = 3.2 to 3.9; length: width = 1.91 to 2.00. Moderate size, black, of somewhat elongate shape but with a slight discontinuity in lateral outline.

Color piceous to black. Head with frontal spots and anterior margin of clypeus rufous; antenna infuscate from antennomeres 4 or 5 to 11; palpi rufous, infuscate apically. Pronotum with lateral bead and disc narrowly mesad to bead rufous to piceous. Elytron black medially, lateral margin and epipleuron piceous. Ventral surface largely black. Legs dark rufous to piceous.

Elytron with meshes of small to moderate size, irregular in size and shape but smaller and more regular laterally and apically; meshes smooth, small punctures present at many intersections of lines. Some females with lines deep and meshes coarse.

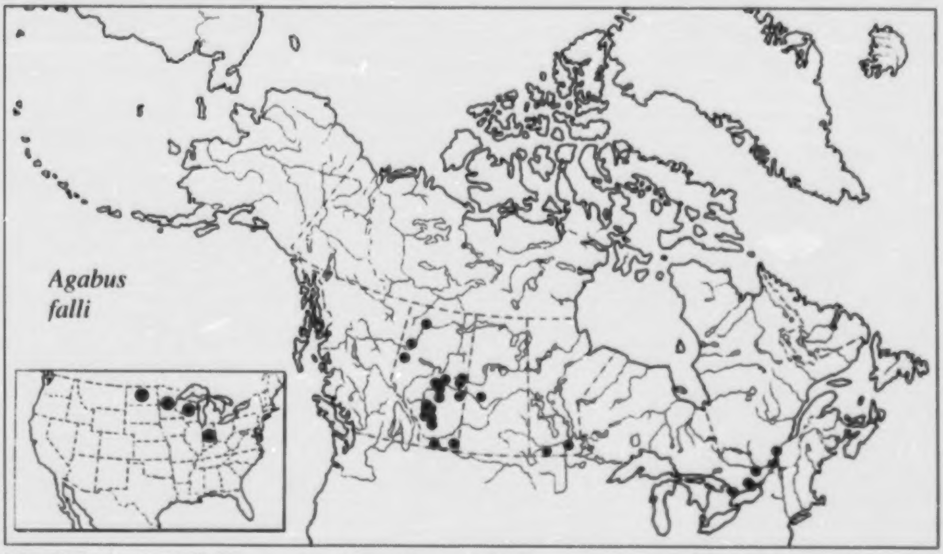
Pronotum with lateral bead broad, subequal in width to maximum width of antennomere 3, of more or less uniform width throughout its length; hind angle about right angled or slightly produced, lateral margin becoming more arcuate towards base and slightly discontinuous in outline with elytron. Prosternal process broad, evenly to angularly convex in cross section, bluntly pointed apically, sparsely setose laterally. Metasternum with anteromedial process relatively broad, impression reaching or almost reaching level of hind margin of mesocoxal cavities; metasternal wing of moderate width, width of metacoxa: width metasternal wing = 2.55 to 3.28. Metafemur length: width = 2.59 to 2.97; metatibia length: width = 4.42 to 4.74, with separated large punctures along posteroventral margin, mesal face with punctures confined to base or some specimens with a few irregularly spaced distal punctures; length of longer spur: length metatarsomere 1 = 0.76 to 0.94.

Male protarsus 3 moderately dilated, width protarsomere 1 = 0.16 to 0.18 mm; protarsal ratio = 2.19: 2.03: 1.73: 1.21: 1; protarsomeres 1 to 3 with small oval adhesive setae of similar size beneath; protarsal claws (Fig. 151A) subequal in length, short, anterior claw with an acute ventrally projecting tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.47 to 0.49. Meso- and metafemora each with a sparse brush of short, erect, pale setae. Suture between sterna 2 and 3 raised into a low, sharp ridge (plectrum of a stridulatory organ), metafemur with a series of oblique ridges (stridulatory file). Aedeagus (Fig. 151C, D) apex with a short longitudinal ridge on ventral surface, apex bent to right in dorsal aspect.

Comments. *Agabus falli* is similar to members of the *affinis*-group in its dark color, elongate shape, form of the tooth of the male protarsal claw and ventroapical ridge of the aedeagus. However, it has the opposite form of stridulatory organ and is therefore included in the *uliginosus*- group.

Ecology. This is a species of temporary, vernal ponds. The beetles occur amongst flooded grasses and sedges of ponds within mixed or deciduous forest areas as well as in parkland and fescue grassland. Adults, which are the overwintering stage, occur in ponds very early in the spring, just when melting snow has filled the pond basin and flooded surrounding grasses and sedges. Specimens occur in both vernal ponds with grass and sedge margins as well as longer lasting ponds such as those with *Typha* stands.

Distribution. Map 177. The range extends from New England to northeastern British Columbia.



Map 177. *Agabus falli* (Zimmermann). Canadian and Alaskan collection localities and United States state records.

64. *Agabus margaretae* Larson 1975

Fig. 151E – G

Agabus margareti Larson 1975: 344. Type locality - 1/4 mi. S Little Fish Lake Provincial Park, Hand Hills, Alberta. Type in CNC. Ending here emended to correct for gender.

Description. Length = 5.3 to 6.0 mm; width = 3.0 to 3.4 mm; length: width = 1.70 to 1.87. A very small, broadly oval species.

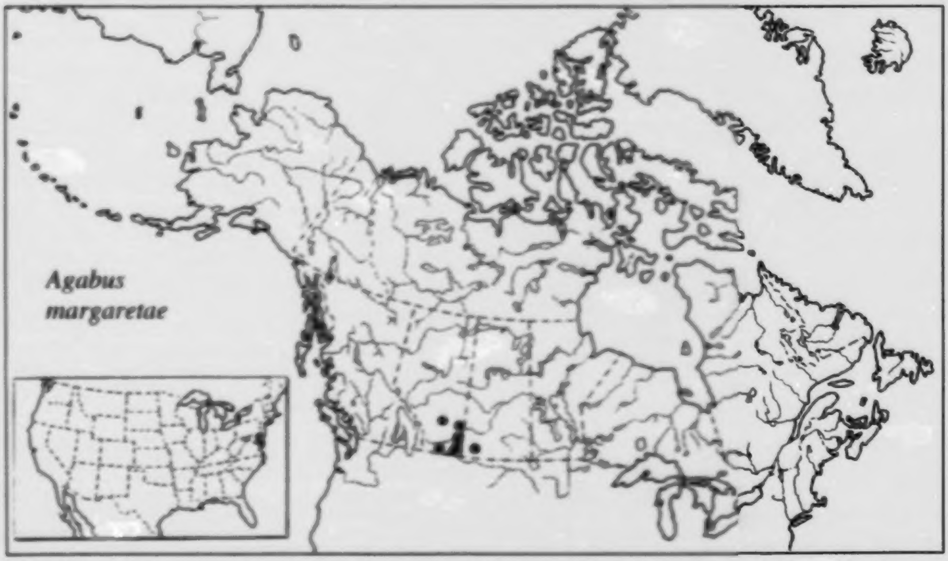
Color rufopiceous to almost black. Head with frontal spots and anterior margin rufous; antenna pale basally, apical 4 or 5 antennomeres infuscate apically; palpi pale basally, infuscate apically. Pronotum with lateral margin broadly but diffusely rufous to piceous. Elytron reddish brown laterally, darker medially, disc without pale spots. Ventral surface dark rufous to piceous. Legs reddish-brown, femora infuscate.

Sculpture similar on both sexes. Elytron with meshes of irregular size and shape, largest basally and becoming smaller apically; small but distinct punctures present at many intersections of lines; meshes smooth and shiny, without microreticulation. Metacoxal plate with variously separated longitudinal lines and transverse rugae, interspaces smooth or with largely effaced microreticulation.

Pronotum with lateral bead broad, at widest subequal to apical width of antennomere 3, slightly narrowing anteriorly; posterolateral angle narrowly rounded and slightly obtuse, lateral curvature of pronotum slightly discontinuous with that of elytron . Prosternal process strongly convex but rounded in cross section, smooth an glabrous medially, pointed apically. Metasternum with anteromedial process narrow, impression short, not or barely reaching level of hind margin of mesocoxae; width of metacoxa: width metasternal wing = 2.09 to 2.40. Metafemur length: width = 3.04 to 3.25. Metatibia length: width = 4.38 to 5.20; with large punctures along posteroventral margin; ventral face with punctures on basal one-half to two-thirds, without micropunctation; length of longer spur: length metatarsomere 1 = 0.93 to 1.0. Tarsal claws very short, those of mesotarsus subequal in length to length of mesotarsomere 4.

Male with protarsomeres 1 to 3 very slightly dilated, width protarsomere 1 = 0.11 to 0.12 mm; protarsal ratio = 1.56: 1.44: 1.31: 1.06: 1; extreme apex of protarsomere 1 and tarsomeres 2 and 3 with a few small, oval scales; protarsomere 5 with anteroventral margin slightly produced in the form of a small external apical ridge, anterior protarsal claw slightly longer than posterior, with a small, obtuse ventral tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46. Stridulatory organ absent. Male genitalia with parameres (Fig. 151G) slender and rod-like, with a dense brush of long black setae at apex; aedeagus (Fig. 151E, F) short, basal piece very large, apex slender and straight.

Comments. The Siberian species, *A. vereschaginae* Angus 1984, also has slender, almost rod-like parameres which are longer than the aedeagus. However these are tipped with shorter yellow setae rather than the long black setae of *A. margaretae*. The two species belong to the same complex but have enough differences (namely clubbed antenna and a stridulatory organ present in *A. vereschaginae* but lacking in *A. margaretae*) that they are probably not sister species. *Agabus vereschaginae* is also an inhabitant of vernal pools in aspen steppe.



Map 178. *Agabus margaretae*. Larson Canadian and Alaskan collection localities and United States state records.

Ecology. These insects are known only from the northern prairies where they occur in vernal, grassland ponds, both on short grass prairie as well as in marginal parkland areas where patches of aspen and willow occur around temporary ponds. Very few specimens have been collected and most have come from ponds on undisturbed, ungrazed prairie although some have been collected from grassy road-allowance pools. Grazing and cultivation appear to be detrimental to the species, which may be endangered due to the widespread impact of agricultural activities on the prairies.

Distribution. Map 178. The distribution is remarkably limited for all known records are from the prairie regions of Alberta and Saskatchewan.

65. *Agabus triton* Fall 1922

Fig. 151H – L.

Agabus triton Fall 1922: 17. Type locality - Edmonton, Alberta. Type - MCZC, male, no. 23977, examined.

Selected References. Carr and Leech 1966: 546; Larson 1975: 343.

Description. Length = 6.5 to 7.6 mm; width = 3.6 to 4.1 mm; length: width = 1.73 to 1.84. This is a moderate size, broadly oval, convex species.

Color brown to piceous. Head piceous with frontal spots and anterior margin rufous; antenna and palpi rufous, each infuscate apically. Pronotum with disc piceous, lateral margin broadly rufous. Elytron brown, darkened medially. Ventral surface rufous to piceous. Legs rufous.

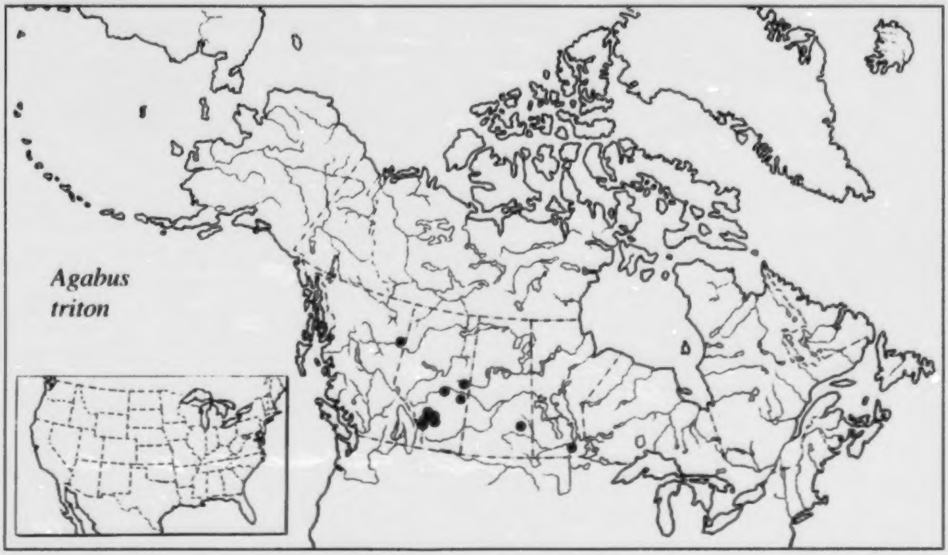
Elytron with lines shallowly impressed, forming polygonal meshes of varied size and shape; small punctures present at many intersections of lines. Metacoxal plate with irregular longitudinal meshes and some shallow transverse rugae, meshes shiny or with faint remnants of microreticulation.

Pronotum with lateral bead very broad, gradually narrowing anteriorly then abruptly ended at base of small, denticulate anterolateral angle; posterolateral angle narrowly rounded to obtuse, lateral margin of pronotum and elytron slightly discontinuous. Prosternal process strongly convex in cross section, punctate and setose. Metasternum with anteromedial process narrow, impression narrow and short and not or just reaching level of hind margin of mesocoxal cavities; width of metacoxa: width metasternal wing = 2.07 to 2.38. Metafemur length: width = 2.90 to 3.10. Metatibia length: width = 4.00 4.50; with large punctures along at least basal half of posteroventral margin, on some specimens extending entire length; length of longer spur: length metatarsomere 1 = 0.81 to 0.89.

Male protarsomeres 1 to 3 dilated, width protarsomere 1 = 0.18 to 0.20, protarsal ratio = 2.35: 2.11: 1.66: 1.13: 1 (protarsomere 5 strongly clavate, measurement taken at middle of length); with small oval adhesive setae beneath; anterior protarsal claw (Fig. 151H) subequal in length to posterior claw, broadly dilated ventrally and with apex obliquely truncate. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.47 to 0.50. Paramere (Fig. 151I) strap-like; aedeagus (Fig. 151J - L) very long and slender, apex twisted to right.

Ecology. The beetles occur in vernal ponds in fescue or tall grass prairie and aspen parkland. Like *A. margaretae*, the species does not seem to tolerate grazing and its uncommon status may reflect the paucity of undisturbed habitat. Adults are active as early in the spring as open water exists and teneral specimens have been collected in late June. The species apparently is adapted to shallow snow-melt ponds that dry up during the summer.

Distribution. Map 179. This species is known only from the parkland zone of the Canadian prairies.



Map 179. *Agabus triton* Fall. Canadian and Alaskan collection localities and United States state records.

Agabus ambiguus-group
Figs. 152; 153.

Diagnosis: Medium to moderately large species, length = 5.7 to 10.0 mm. Body mainly piceous to black with at least elytra brown to piceous and distinctly paler than disc of pronotum, or entire body reddish brown. Dorsal surface with very coarse meshes which in turn bear fine isodiametric reticulation. Metafemur with strong, oblique strioles. Clypeus with anterior bead complete; frontal punctures present. Pronotum with anterior submarginal series of punctures complete or only narrowly broken medially. Prosternal process variously convex to tectiform in cross section, apex acuminate and received into well developed anteromedial impression of metasternum which extends posteriorly to level of hind margin of mesocoxae. Metacoxal lines clearly traceable to mesosternum. Metatibia with punctation of ventral surface reduced, most specimens with posteroventral series of punctures absent or reduced to a few isolated punctures along basal half but some specimens with a few small punctures also on distal half; medioventral face micropunctate or smooth; longer metatibial spur shorter than metatarsomere 1. Metatarsomeres without accessory dorsal or ventral punctures. Male protarsomeres slightly to moderately dilated, protarsomeres 1 to 3 together with both small adhesive hairs and larger oval suckers, protarsomere 1 with a basoventral group of small adhesive setae and one or two transverse rows of 4 to 6 large adhesive setae near apex, protarsomeres 2 and 3 each with one row of large setae and variable numbers of

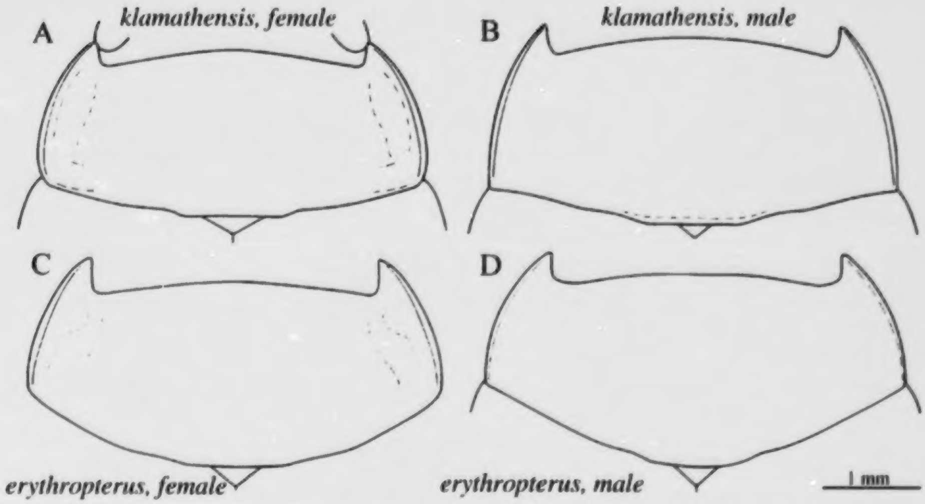

A
klamathensis, female
B
klamathensis, male
C
D
erythropterus, female
erythropterus, male
1 mm

Fig. 152. *Agabus ambiguus*-group, pronotum. A – B - *A. klamathensis*, A - female, B - male. C – B - *A. erythropterus* , C - female, D - male.

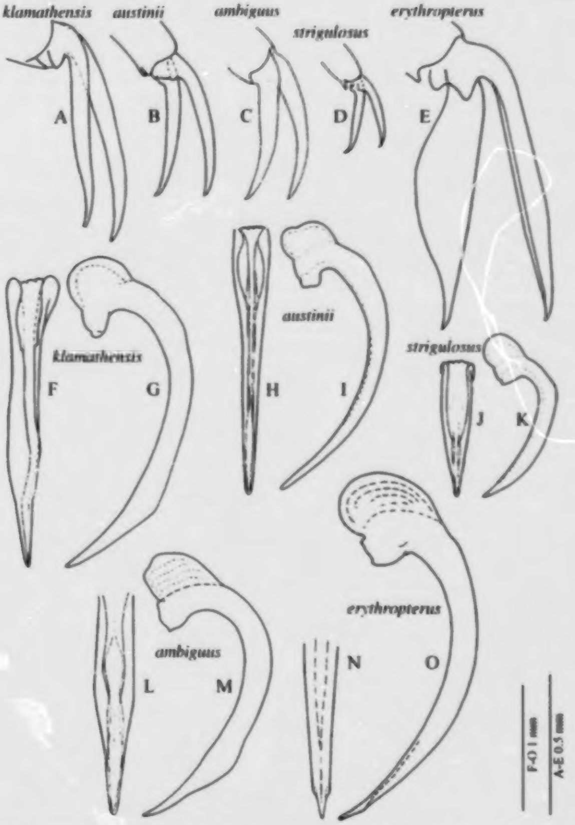

klamathensis
austinii
ambiguus
strigulosus
erythropterus
A
B
C
D
E
klamathensis
F
G
austinii
H
I
strigulosus
J
K
ambiguus
L
M
erythropterus
N
O
F-O 1 mm
A-E 0.5 mm

Fig. 153. *Agabus ambiguus*-group. A – E - male protarsal claws, anterior. A - *A. klamathensis*. B - *A. austinii*. C - *A. ambiguus*. D - *A. strigulosus*. E - *A. erythropterus*. F – O - aedeagus. F - G - *A. klamathensis*, F - dorsal, G - lateral. H – I - *A. austinii*, H - dorsal, I - lateral. J – K - *A. strigulosus*, J - dorsal, K - lateral. L – M - *A. ambiguus*, L - dorsal, M - lateral. N – O - *A. erythropterus*, N - ventral, O - lateral.

lateral adhesive hairs. Paramere with basal sclerite oval, apex elongate and setose mesally and ventrally; aedeagus (Fig. 153F - O) with basal apodemes of average size, apex simple without a subapical ventral spine, it and dorsal groove straight or twisted slightly to right in dorsal aspect. Gonocoxa triangular, surface moderately sclerotized and with short sensillae except for a tight cluster of setae subapically.

Comments. This Nearctic group contains four species which were revised by Larson (1989). The species occur in permanent, slowly flowing water and are usually in depositional areas with organic silts and emergent plants.

66. *Agabus klamathensis* Larson and Leech 1989

Figs. 152A, B; 153A, F, G

Agabus klamathensis Larson and Leech 1989: 875 – 876. Type locality - 5 mi. S Ft. Klamath, Klamath Co., Oregon. Type in CASC.

Selected Reference. Larson 1989: 875 – 876.

Description. Length = 8.1 to 9.2 mm; width = 4.1 to 4.8 mm; length: width = 1.86 to 2.02. Moderate size, sexually dimorphic in shape.

Color pale to dark brown. Head dark red to pale brown posteriorly and medially, with frontal spots, labrum and at least anterior half of clypeus pale reddish brown; palpi yellowish brown with apex of terminal palpomeres faintly infuscate; antenna testaceous with at least apical antennomeres lightly infuscate apically. Pronotum reddish brown to brown with lateral margins, including front angles, broadly paler. Elytron pale, yellow brown basally and laterally, darkened medially and apically; epipleuron pale. Ventral surface mainly piceous to black. Legs reddish yellow to brown, hind legs evidently darkened.

Sculpture of dorsal surface consisting of coarse, irregular meshes; microreticulation present but variously effaced, especially on male. Pronotum with meshes longitudinally stretched, at least mediolaterally on disc and sub-basally along hind margin; male with microreticulation obsolete but with very fine punctures. Elytron of male with many meshes longitudinal basomedially and along margins, otherwise more or less irregular over remainder of disc or slightly transverse apically and laterally; microreticulation effaced basomedially, fine but evident laterally and apically. Female dorsal sculpture with lines denser and meshes more elongate on pronotum and base of elytron than on male; micro reticulation well developed making surfaces duller. Prosternal process smooth, finely and sparsely punctate. Metasternum smooth, with isolated transverse strioles. Metacoxal plates coarsely reticulate with meshes generally longitudinal or oblique in orientation, microreticulation present but largely effaced on male. Metafemur with longitudinal strioles. Metatibia with ventral surface micropunctate.

Pronotum (Fig. 152A, B) with lateral bead about two-thirds maximum width of a middle antennomere, widest medially and narrowed onto front angle and less evidently so onto posterior angle: pronotal shape sexually dimorphic, male posterolateral angles more or less right angled but narrowly rounded, lateral margin of pronotum and elytron slightly discontinuous in dorsal aspect, disc flat or slightly and evenly convex mesad to lateral bead; female hind angles broadly rounded making lateral outline of body distinctly discontinuous in dorsal aspect, many females with lateral margin longitudinally inflated just mesad to lateral bead. Prosternum and its process in same plane in lateral aspect, both with similar longitudinal convexity; process narrow, strongly arched in cross section but medially rounded and not carinate, apex sharply pointed. Metasternum with anteromedial impression sharply incised and deep, extending posterad to level of hind margin of mesocoxae; width of metacoxa: width metasternal wing = 3.68 to 5.50. Metafemur length: width = 2.84 to 2.98. Metatibia with small, separated punctures along at least basal half of posteroventral margin, some specimens with punctures along entire length.

Male protarsus narrowly dilated, protarsal ratio = 1.71 : 1.45 : 1.22 : 1.03 : 1.00; protarsomere 1 with adhesive setae and a transverse row of 5 to 6 larger scales apically, protarsomeres 2 and 3 each with a transverse row of scales and a few smaller setae; protarsomere 5 with ventral setae forming a dense longitudinal brush of apically converging setae; protarsal claws (Fig. 153A) elongate, anterior slightly shorter than posterior; in anterior aspect both slender and slightly arcuate except at more strongly curved apex, each with an acute ventral basal projection; in ventral aspect claws flattened, anterior claw with anterior margin broadly arcuate, posterior claw narrower and more parallel sided basally and more evenly narrowed apically. Mesotarsus with claws elongate, posterior claw broader than anterior in lateral aspect; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.87. Aedeagus (Fig. 153F, G) asymmetrical in dorsal aspect, apex curved to right, lateral margin of dorsal groove broadened and covering side of groove submedially, both sides in this area roughly spiculate.

Ecology. The species occurs in springs and small streams where there is water movement or flushing but currents are very slight and silt accumulation and emergent vegetation occur.

Distribution. This species is known from southern Oregon and northern California.

67. *Agabus austinii* Sharp 1882

Fig. 153B, H. I

Agabus austinii Sharp 1882*a*: 516. Type locality - Utah. Type - BMNH, male, no. 792, examined.

Selected References. Larson 1989: 878 – 879; Larson 1997*b*: 508.

Description. Length = 7.5 to 9.1 mm; width = 3.9 to 4.9 mm; length: width = 1.80 to 2.00. Moderate sized, brown species; body in dorsal aspect evenly ovate with lateral margins of pronotum and elytra more or less continuous in outline .

Color pale to dark brown. Head and pronotum pale to dark brown or piceous; elytron brown to piceous; epipleuron pale brown. Ventral surface mainly piceous to black. Antenna testaceous except antennomere 11, and on some specimens also 10, infuscate apically. Palpi testaceous, terminal palpomere of each palpus lightly infuscate. Front and middle legs pale brown to rufous, hind legs slightly darker.

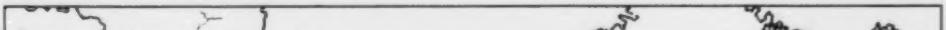
Sculpture of elytron consisting of large meshes; male with meshes slightly longitudinal basomedially, more irregular apically, laterally meshes transverse, microreticulation obsolete or lightly impressed medially, more evident apically; female sculpture similar but meshes with more evident longitudinal stretching, microreticulation stronger medially on disc.

Prosternal process in lateral aspect on same plane or only slightly stepped down from plane of midline of prosternum; process strongly convex but rounded in cross section, surface smooth, largely glabrous. Width of metacoxa: width metasternal wing = 3.07 to 4.26. Metafemur length: width = 2.80 to 3.29. Metatibia with punctures on posteroventral margin restricted to basal quarter to third of length on most specimens but some specimens with irregular small punctures along much of length; ventral face with sparse, fine micropunctation.

Male protarsomeres 1 to 3 narrowly dilated, protarsal ratio = 1.60 : 1.40 : 1.23 : 1.07 : 1; tarsomere 1 with dense adhesive setae, tarsomeres 2 and 3 of most specimens with from 4 to 6 oval scales in addition to ventrolateral adhesive setae: protarsal claws (Fig. 153B) slender, anterior claw slightly narrower and shorter than posterior, with outer margin slightly arcuate, inner margin almost straight. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.71 to 0.82. Aedeagus (Fig. 153H, I) simple, slender.

Ecology. This is a species of depositional areas of cold, clear springs and small streams. The beetles occur in sites where there are emergent plants and organic substrates. Both larvae and adults overwinter (Larson 1975).

Distribution. Map 180. The distribution is exclusively Cordilleran, ranging from the southern Yukon and southwestern Northwest Territories to California and New Mexico. East of the Rocky Mountains, isolated populations occur in the Cypress Hills of Alberta and Saskatchewan, eastern ranges of Wyoming, and the Black Hills, South Dakota.



68. *Agabus ambiguus* (Say 1823)

Fig. 153C, L, M

Colymbetes ambiguus Say 1823: 96. Type locality - eastern Pennsylvania.

Selected References. Larson 1989: 879 – 883; Hilsenhoff 1993*c*: 180 – 181; Larson 1997*b*: 507.

Description. Length = 7.4 to 8.7 mm; width = 3.8 to 4.5 mm; length: width = 1.85 to 2.04. Moderate size; pronotum and elytra of male with lateral margins more or less continuous in dorsal aspect, female with margin more discontinuous due to slight rounding of posterolateral angles of pronotum.

Forebody black, elytra paler. Head black except frontal spots, anterior margin of clypeus, and labrum, rufous; antenna pale rufous, outer antennomeres infuscate apically; palpi pale except terminal palpomere of each palpus lightly infuscate. Pronotum black except lateral bead and margin narrowly mesad to bead, rufous; posterior margin piceous. Elytron with lateral and basal margin light brown, disc darker brown to piceous; epipleuron piceous to black, narrowly rufous along outer margin. Ventral surface mainly black. Legs rufous except metafemur and tibiae dark rufous or piceous, at least medially.

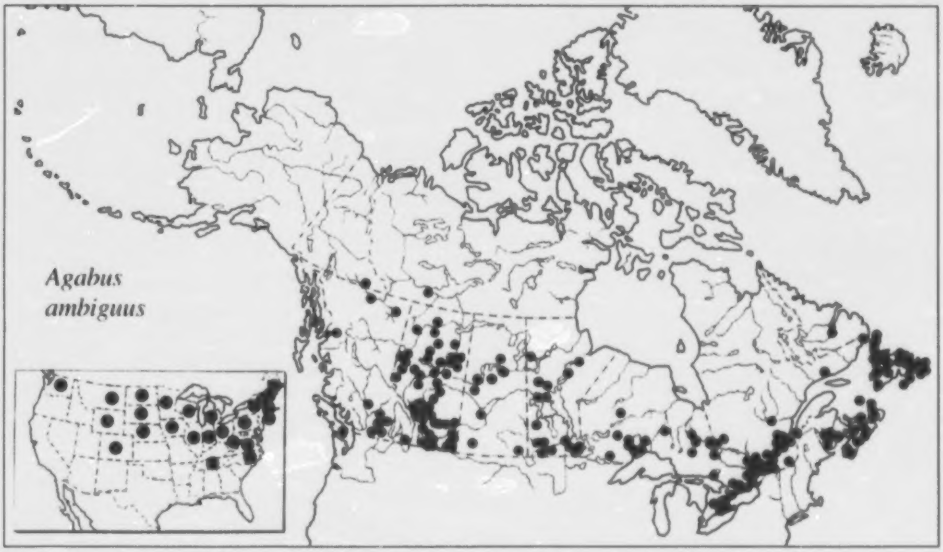
Elytron with large irregular meshes, slightly longitudinal in orientation basally (best developed on female); isodiametric microreticulation present on meshes, this microreticulation somewhat effaced medially on some males, stronger on females than males.

Pronotum with lateral bead of moderate width, well defined almost to front angle. Prosternal process in lateral aspect slightly stepped down from plane of prosternum and less convex; in cross-section process slightly and broadly convex basally, strongly convex apically; surface smooth and only sparsely punctate, apex acuminate. Width of metacoxa: width metasternal wing = 2.73 to 3.73. Metafemur length: width = 2.73. Metatibia with punctation of posteroventral margin various, ranging from punctures lacking to separated punctures extended onto apical half; ventral face with a small group of basal punctures otherwise surface with somewhat longitudinal micropunctures scattered over surface.

Male protarsal ratio = 2.15:1.87:1.59:1.19:1; protarsomere 1 with adhesive setae basally and a single row of larger oval adhesive scales apically; protarsomeres 2 and 3 with scales only; protarsal claws (Fig. 153C) elongate, slender; posterior claw slightly longer than anterior and broader in dorsal aspect. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.68. Male genitalia with aedeagus (Fig. 153L, M) simple, apex narrowly flanged laterally, not twisted.

Ecology. This lotic species occurs in depositional areas of springs, small streams and stream-fed ponds such as beaver ponds, generally where there are emergent plants and organic substrates. It is most abundant in forested regions but it also occurs in prairie springs and streams.

Distribution. Map 181. The range extends from the Atlantic provinces to central and northern British Columbia and the southeastern Yukon Territory, and south to Tennessee and Colorado.



Map 181. *Agabus ambiguus* (Say). Canadian and Alaskan collection localities and United States state records.

69. *Agabus strigulosus* (Crotch 1873)

Fig. 153D, J, K

Gaurodytes strigulosus Crotch 1873: 422. Type locality - Lake Tahoe, California. Lectotype - MCZC, male, no. 748, examined.

Selected References. Larson 1989: 883 – 884; Larson 1997*b*: 510.

Description. Length = 5.7 to 7.1 mm; width = 2.9 to 3.6 mm; length: width = 1.90 to 2.10. A small, relatively narrow species.

Forebody mainly black, elytron paler. Head black except frontal spots, and on some specimens, anterior margin of clypeus, rufous; antenna testaceous with antennomeres 4 or 5 to 11 infuscate apically; palpi testaceous except apical palpomere infuscate apically. Pronotum black medially, lateral margin narrowly rufous. Elytron dark brown to piceous medially, lateral margin and especially humerus, rufous to brown; epipleuron piceous to black. Ventral surface mainly black with metacoxal processes and posterior margins of sterna 3 to 6 rufous. Legs rufous with coxae and femora basally and medially, infuscate.

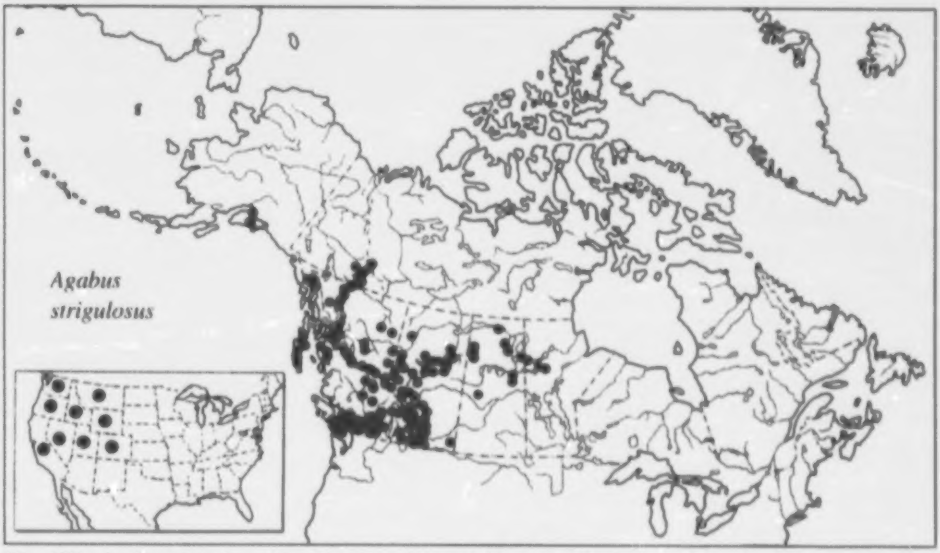
Elytron with large irregular meshes, meshes longitudinal basomedially on many specimens; with fine isodiametric microreticulation.

Pronotum with lateral bead complete but narrow. Prosternum longitudinally angulate medially; process slightly stepped down from plane of prosternum; process broad, smoothly convex to obtusely angulate medially, densely punctate and setose, apex sharply pointed. Width of metacoxa: width metasternal wing = 2.44 to 3.25. Metafemur narrow, length: width = 3.04. Metatibia with punctation of ventral margin various, ranging from one or two basal punctures on some specimens to an almost complete line of narrowly separated punctures on basal half; ventromedial series of punctures on basal one-third to one half otherwise metatibia mainly smooth and impunctate or with very sparse micropunctation.

Male protarsomeres 1 to 3 narrowly dilated, protarsal ratio = 2.15:1.67:1.56:1.13:1; protarsomere 1 with setae basally and a row of small oval scales apically; protarsomeres 2 and 3 with small scales and adhesive setae beneath; protarsal claws (Fig. 153D) narrow, little modified, anterior claw slightly longer than posterior. Mesotarsomere 5 short, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.57. Aedeagus (Fig. 153J, K) simple, evenly narrowed towards apex, not flanged or ridged.

Ecology. These beetles occur among emergent vegetation in small pools or at the margins of larger ponds. They are found in or near sites of water movement but are not as clearly associated with flushing as other members of the group.

Distribution. Map 182. This western species occurs from the northern portions of the prairie provinces to the Pacific and from the southern Yukon Territory and Alaska south to Colorado, Utah and California. An isolated population occurs in the Cypress Hills of Alberta.



Map 182. *Agabus strigulosus* (Crotch). Canadian and Alaskan collection localities and United States state records.

70. *Agabus erythropterus* (Say 1823)

Figs. 152C, D; 153E, N, O

Colymbetes erythropterus Say 1823: 95. Type locality - not stated, type lost.

Selected Reference. Larson 1989: 884 – 887.

Description. Length = 8.1 to 9.9 mm; width = 4.5 to 5.6 mm; length: width = 1.75 to 1.88. A large, broad species with point of maximum width distinctly posterad of middle.

Forebody black, elytra paler. Head mainly black except anterior margin and frontal spots, reddish; antenna testaceous basally, antennomeres 3 or 4 to 11 darkened apically; palpi reddish yellow except apical palpomere of each palpus infuscate. Pronotum black, anterolateral angles and on most specimens lateral bead and disc adjacent to bead narrowly rufous. Elytron testaceous to pale brown basally and laterally, darker brown medially and apically; epipleuron piceous to black except anterior and lateral portions rufous. Ventral surface mainly piceous to black, sterna 3 to 6 reddish apically. Front and middle legs rufous except femora piceous on basal two thirds; hind legs mainly piceous with tarsi paler.

Sculpture sexually dimorphic. Male pronotum with meshes longitudinally stretched subbasally, laterally and anteromedially on most specimens, microreticulation more or less obsolete or lightly impressed; elytron with meshes irregular and without evident longitudinal stretching, microreticulation fine. Female differing from male in that lines of sculpture on pronotum and elytra are denser and on elytra meshes are strongly longitudinal on at least basal half of disc; microreticulation stronger and surface more matte. Ventral surface of body with sculpture similar on both sexes, metasternum with deep, separated transverse strioles; metacoxal plate with coarse, oblique to transverse meshes.

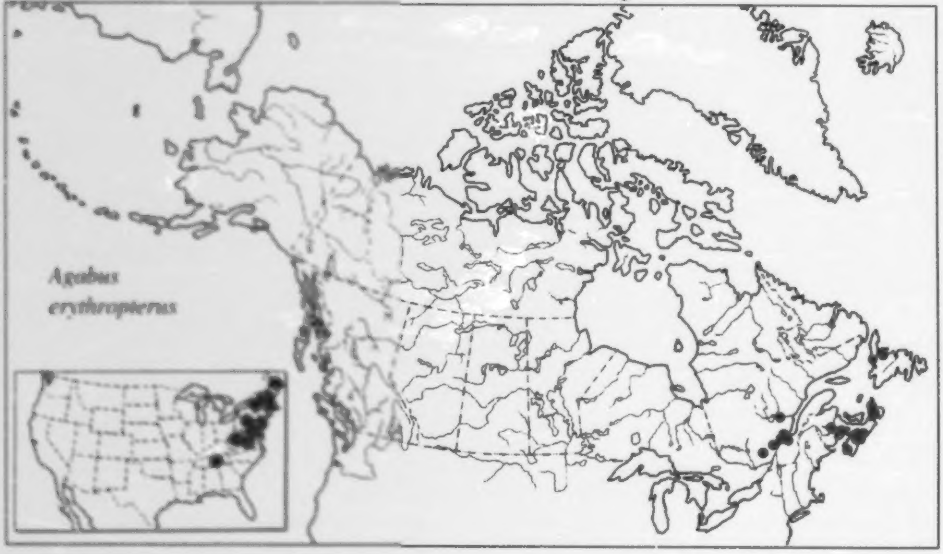
Pronotum (Fig. 152C, D) more arcuate in outline than elytra therefore body outline discontinuous in dorsal aspect; hind margin of pronotum semicircular. Pronotum sexually dimorphic; male with pronotal bead of moderate width, well delimited along length, at widest about two-thirds width of an outer antennomere, gradually narrowed towards hind angle, disc evenly convex mesad of bead, posterolateral angle obtuse but distinct; female with lateral bead broader anteriorly, disc more or less inflated mesad of bead into an elongate submarginal tumid area, hind angle broadly rounded and indistinct or broadly obtuse. Prosternum and its process in same plane in lateral aspect and similar in convexity, medial convexity strong, subangulate but narrowly rounded medially; process with surface finely and sparsely punctate, apex acuminate. Width of metacoxa: width metasternal wing = 2.55 to 3.62. Metafemur broadly clavate, length: width = 2.6 to 2.9. Metatibia lacking punctures along posteroventral margin; ventral face with sparse, fine micropunctation.

Male protarsomeres 1 to 3 broadly dilated, protarsal ratio = 2.27:1.97:1.72:1.10:1; protarsomere 1 ventrally with dense adhesive setae and two transverse apical rows of adhesive scales; protarsomeres 2 and 3 each with one transverse row of scales plus some smaller adhesive setae; protarsomere 5 ventrally with two longitudinal rows of dense, short setae on ventral surface, rows broadly arcuate anteriorly; protarsal claws (Fig. 153E) elongate, flattened ventrally and broadly expanded laterally in dorsal aspect, anterior claw slightly shorter than posterior.

Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 1.04 to 1.12, claws enlarged, anterior slightly longer and broader than posterior. Aedeagus (Fig. 153N, O) more or less symmetrical in dorsal aspect, with subapical lateral flanges.

Ecology. Most specimens have been collected from amongst emergent sedges at the margins of beaver ponds or along, slow sections of streams. These beetles are usually associated with slowly flowing water but occur in depositional areas where there is thick organic silt. They are often in sites where the water remains cool due to springs.

Distribution. Map 183. The range is primarily restricted to the Atlantic seaboard and Appalachian Mountains, from Newfoundland south to Virginia.



Map 183. *Agabus erythropterus* (Say). Canadian and Alaskan collection localities and United States state records.

Agabus tristis-group
Figs. 154; 155

Necticus Hope 1838: 131, 140. Type species - *Dytiscus bipustulatus* Linnaeus, by original designation. Not Laporte 1835.

Gaurodytes Thomson 1859: 14. Type species - *Dytiscis bipustulatus* Linnaeus, by original designation.

Diagnosis. Moderate sized species, length = 8.2 to 11.0 mm. Body (Fig. 155) relatively elongate with elytra more pointed or attenuate apically than in most species of the genus. Sculpture of coarse meshes which bear fine, isodiametric reticulation; many specimens with meshes longitudinal in orientation on pronotum and base of elytra. Metafemur with deeply impressed strioles. Clypeal bead complete; frontal punctures present. Pronotum with anterior submarginal row of punctures complete. Prosternal process in lateral aspect in same plane as midline of prosternum; process pointed apically, in cross section smoothly convex to angulate, surface punctate and setose; lateral margin not inflated. Metasternum with anteromedial impression sharply impressed, length of impression

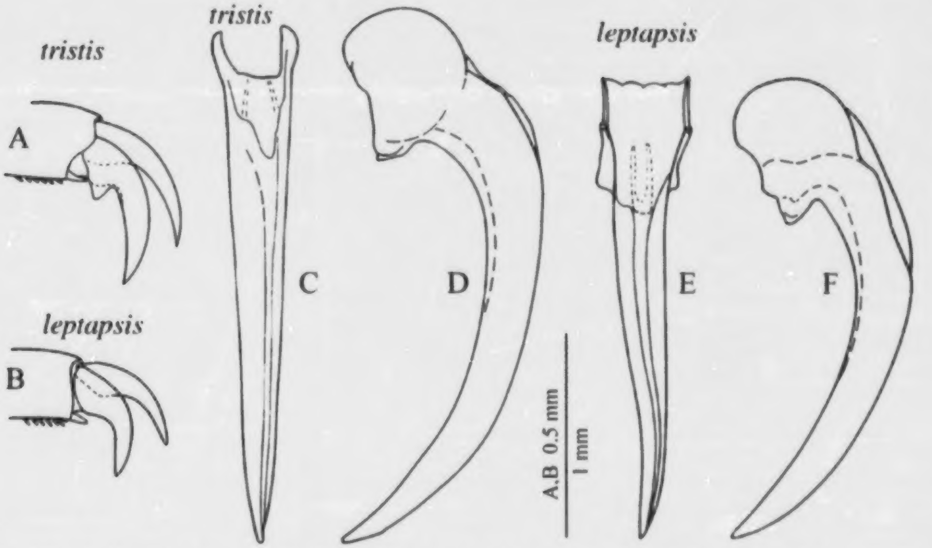


Fig. 154. *Agabus tristis*-group. A – B - male protarsal claws, anterior. A - *A. tristis*. B - *A. leptapsis*. C - F - aedeagus. C – D - *A. tristis*, C - dorsal, D - lateral. E – F - *A. leptapsis*, E - dorsal, F - lateral.

various, on North American species short and not attaining level of hind margin of mesocoxae. Metatibia with punctures of posteroventral margin small, closely spaced and forming a more or less continuous groove along length of tibia. Metatibial spur slightly shorter than metatarsomere 1. Metatarsomeres without axillary setae on dorsal or ventral surfaces. Male protarsomeres 1 to 3 moderately dilated, strongly convex dorsally in cross-section, ventral surface of each bearing dense adhesive setae or adhesive setae plus a transverse row of larger scales; anterior protarsal claw simple or with a basal tooth (Fig. 154A). Mesotarsus with anterior claw slightly to strongly broadened in lateral aspect, elongated on some species. Paramere with basal sclerite transverse in shape; apical lobe membranous, slender and setose. Aedeagus elongate, basal apodemes large; in dorsal aspect dorsal groove lying to right side of shaft and terminating subapically on the right; margins of shaft symmetrical or slightly curved. Female gonocoxae laterally flattened, triangular, moderately sclerotized.

Comments. This group contains seven species in the Palaearctic region and two in the Nearctic region. One species is Holarctic. The North American species were revised by Larson (1989).

71. *Agabus tristis* Aubé 1838

Fig. 154A, C, D

Agabus tristis Aubé 1838*b*: 356. Type locality - "Amerique septentrionale".

Selected References. Larson 1989: 890 – 892; Larson 1997*b*: 510.

Description. Length = 8.2 to 11.0 mm; width = 4.2 to 5.4 mm; length: width = 1.86 to 2.10. Moderate size, body rather narrow and apically attenuated.

Color various. Head dark brown to piceous dorsally, mouthparts and ventral surface variously paler; antenna and palpi reddish yellow, infuscate apically. Pronotum yellow to reddish brown with a medial transverse piceous band which on most specimens is clearly limited anteriorly and laterally but posterior limits vague and band more or less continuous with hind margin (on some specimens medial darkened area broadly expanded over disc except anterolateral angles). Elytron with epipleuron, lateral margin in basal two-thirds, base and narrow band along suture, rufous; disc medially and apically dark brown to piceous (some specimens with entire elytron dark rufous to piceous). Ventral surface rufous to piceous. Front and middle legs rufous with bases of femora infuscate; hind legs darker, dark brown to piceous.

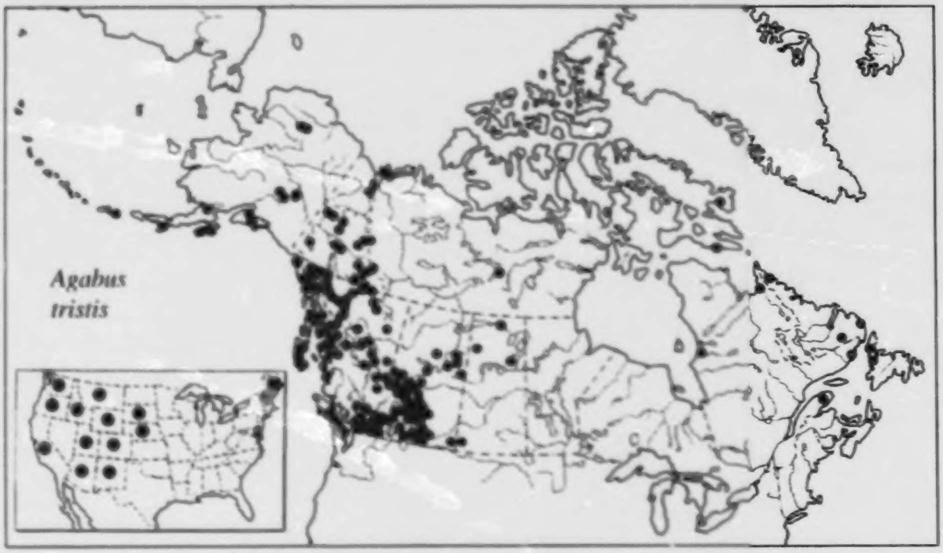
Sculpture sexually varying. Male pronotum with meshes of irregular shape except longitudinal or oblique orientation at least mediolaterally on disc, microreticulation faint or obsolete; elytron with large irregular meshes, basally at least some meshes longitudinally stretched, distally meshes more irregular to evidently transverse; microreticulation somewhat effaced basally but stronger and more or less continuous towards apex. Female with meshes on disc of pronotum narrower, more strongly longitudinal in arrangement; elytron with meshes on base strongly stretched obliquely, more irregular in shape and orientation toward apex, with strong microreticulation. Pattern of sculpturing varying, some females closely approaching male condition.

Pronotum with lateral bead complete; anterolateral angle acute with lateral margin ventrolaterally flattened and sinuate in dorsal aspect on many individuals. Prosternum broadly angulate medially; prosternum and its process in same plane in lateral aspect, both with similar medial convexity or process slightly flattened; apex of process sharply pointed. Metasternum with anteromedial impression slightly short of level of hind margin of mesocoxae; metasternal wing broad, width of metacoxa: width metasternal wing = 2.05 to 3.46. Metafemur clavate, length: width = 2.97, evenly broadened towards apex. Metatibia with a complete row of longitudinally confluent punctures along posteroventral margin; ventral face punctate on at least basal half.

Male protarsomeres 1 to 3 broadly dilated, protarsal ratio = 2.13:1.97:1.60:1.14:1; protarsomeres 1 to 3 ventrally with dense covering of adhesive setae of uniform size; anterior protarsal claw (Fig. 154A) with a ventrobasal tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50. Aedeagus (Fig. 154C, D) elongate and slender.

Ecology. These beetles occur in permanent sites of cold water. In alpine areas, they occur along the margins of ponds and lakes near or above tree-line. In such habitats they are usually found along barren shorelines on gravel or among rocks. At lower elevations beetles are usually among emergent sedges, generally in sites where the water is cold such as in springs, depositional areas of cold streams or in ponds where there is an inflow of cold water. The putative larva was described by Kincaid (1900).

Distribution. Map 184. This Holarctic species is abundant throughout the western Cordilleran region, from Alaska and the Northwest Territories south to California, Arizona and New Mexico. It also occurs in eastern North America, in the eastern arctic and in alpine regions south to New Hampshire and Maine, but in the east it is uncommon and very local in distribution. The western and eastern ranges appear to be separated by a gap which extends from Manitoba to western Quebec. In the Palaearctic region, it occurs on the Asian tundra (Zaitzev 1953).



Map 184. *Agabus tristis* Aubé. Canadian and Alaskan collection localities and United States state records.

72. *Agabus leptapsis* (LeConte 1878)

Figs. 154; 155

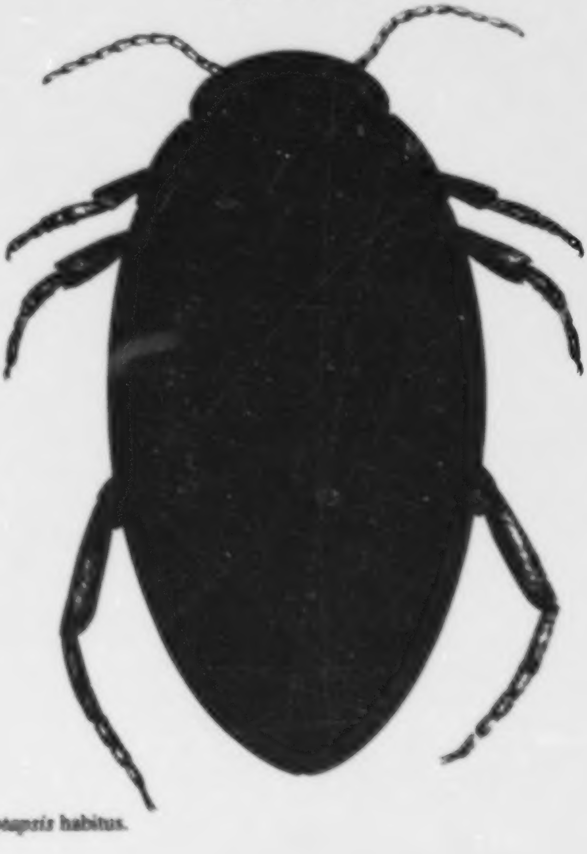


Fig. 155. *Agabus leptapsis* habitus.

Gaurodytes leptapsis LeConte 1878*a*: 596. Type locality - Marquette, Michigan.

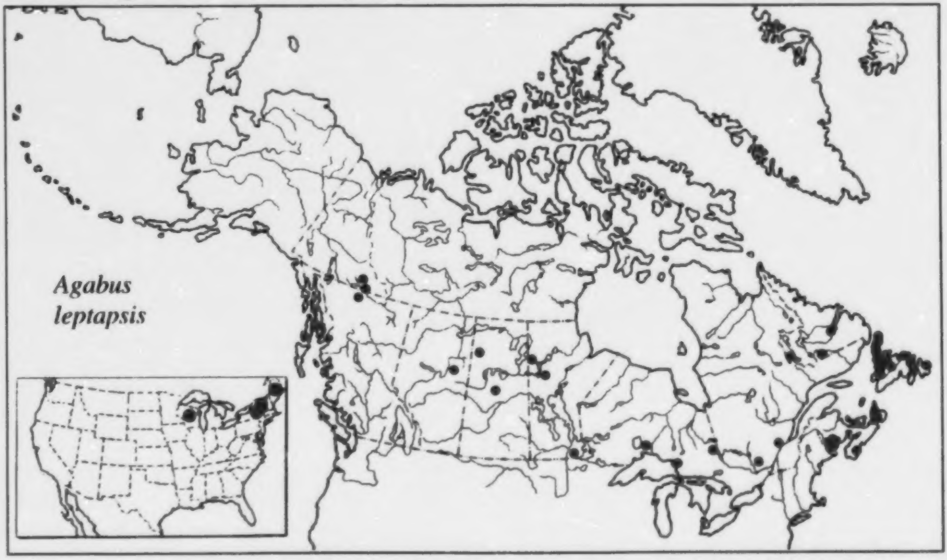
Selected References. Larson 1989: 892 – 893; Hilsenhoff 1993*c*: 187; Larson 1997*b*: 509.

Description. Length = 8.2 to 10.0 mm; width = 4.2 to 5.0; length: width = 1.87 to 2.00. Body relatively elongate (Fig. 155), similar in habitus to *A. tristis* but slightly broader and more rounded anteriorly.

Color primarily black. Head with frontal spots and labrum, rufous; antenna yellow basally, antennomeres 3 or 4 to apex becoming progressively darker; palpi rufous, apical palpomere of each palpus infuscate. Pronotum with lateral and basal margins narrowly piceous. Elytron with shoulder and epipleuron piceous. Metacoxal processes and posterior margins of abdominal sterna 3 to 6, piceous. Legs dark rufous to piceous.

Sculpture sexually varying. Male pronotum with meshes large, medially strongly stretched longitudinally, less so laterally; microreticulation fine but evident laterally, more or less effaced medially; elytron with coarse meshes longitudinally stretched basomedially, more or less oblique in humeral area, irregularly oriented apically; with well developed microreticulation. Female pronotum medially with meshes very narrow and strongly stretched longitudinally, laterally meshes more irregular in shape; microreticulation present over disc; elytron with meshes very narrow and strongly longitudinal or oblique, meshes of irregular shape only near apex; microreticulation strong.

Pronotum in dorsal aspect with lateral margin evenly rounded, not sinuate on anterolateral angle; base strongly sinuate laterally, posterolateral angle acute. Prosternum broadly angulate medially; process angularly convex but narrowly rounded medially, sharply pointed apically; surface distinctly punctate and setose. Metasternal wing broad, width of metacoxa: width metasternal wing = 1.84 to 2.35. Metafemur length: width = 2.87. Metatibia with punctures along posteroventral margin contiguous and forming a more or less complete groove.



Map 185. ***Agabus leptapsis*** **(LeConte). Canadian and Alaskan collection localities and United States state records.**

Male protarsal ratio = 2.47: 2.27: 1.80: 1.29: 1; protarsomeres 1 to 3 with adhesive setae of more or less uniform size on ventral surface; protarsal claws (Fig. 154B) very short, strongly arcuate; anterior claw thickened at base in lateral aspect but without a definite tooth. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.44. Aedeagus (Fig. 154E, F) and paramere similar to that of *A. tristis*.

Ecology. This species occurs along the margins of slowly flowing, boggy or brown water streams. Slightly teneral specimens have been collected in August.

Distribution. Map 185. This Nearctic species has a boreal range which extends from Newfoundland to British Columbia and the Yukon Territory.

Agabus arcticus-group

Figs. 156; 157

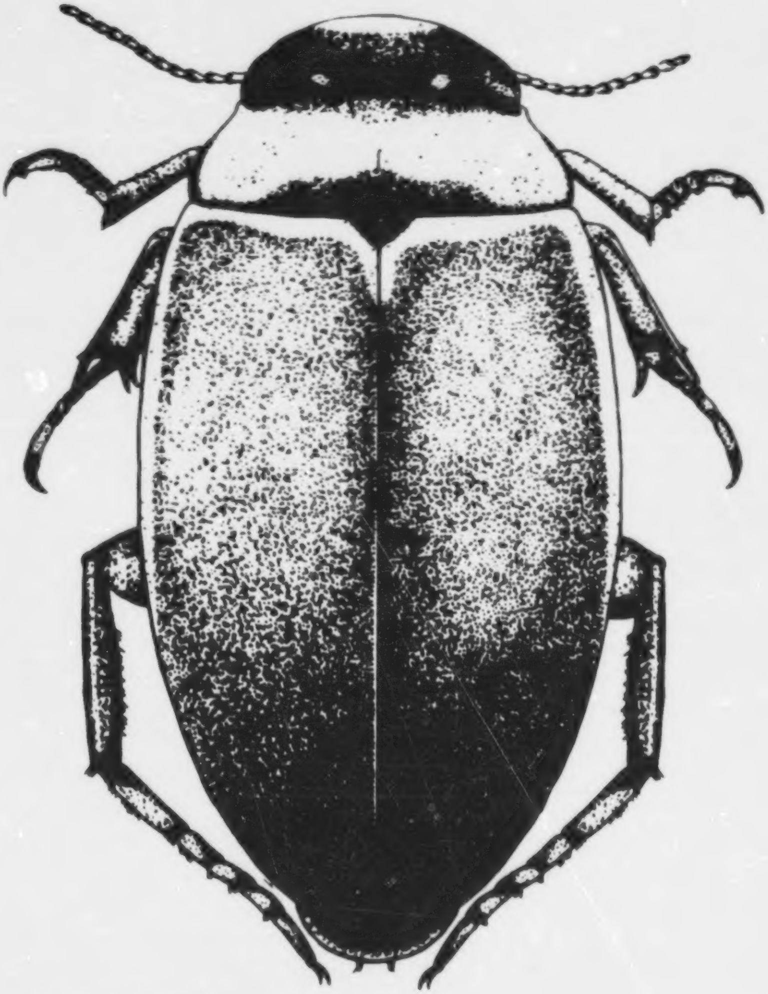


Fig. 156. *Agabus arcticus*, female habitus.

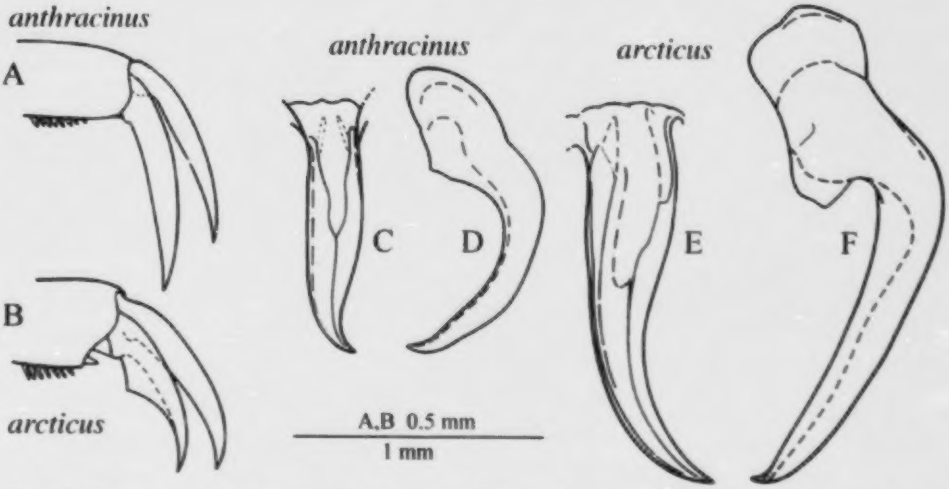


Fig. 157. *Agabus arcticus*-group. A – B - male protarsal claws, anterior. A - *A. anthracinus*. B - *A. arcticus*. C - F - aedeagus. C – D - *A. anthracinus*, C - dorsal, D - lateral. E – F - *A. arcticus*, E - dorsal, F - lateral.

Diagnosis. Medium sized species, length = 6.2 to 8.1 mm. Shape elongate-oval, pronotum slightly more arcuate than lateral margin of elytron thus body with slight discontinuity in lateral outline. Sculpture very coarse, pronotum and elytra with deep lines forming meshes of irregular size and shape; elytron basally without evident orientation of meshes, laterally and subapically many meshes slightly transverse in shape; microreticulation well developed to obsolete. Metafemur with evident oblique strioles. Clypeus with anterior bead complete, evidently widened medially on many specimens. Pronotum with lateral bead narrow; anterior sublateral row of punctures more or less complete. Prosternal process in lateral aspect in same plane or slightly stepped down from plane of prosternum; process basally flat to lowly convex, its apex acuminate and received into sharply impressed metasternal impression which extends posterad to level of hind margin of mesocoxae. Metatibia with a series of separated irregularly spaced punctures along most of posteroventral margin; medioventral face impunctate or sparsely micropunctate; metatibial spur slightly shorter than metatarsomere 1; metatarsomeres lacking dorsal or ventral accessory punctures. Male protarsomeres 1 to 3 ventrally bearing a small number of large rounded suckers. Paramere stylate with basal sclerite ovate; aedeagus (Fig. 157C – F) with very large basal apodemes; shaft in lateral aspect rather strongly bent or angulate basally; in dorsal aspect apex twisted strongly to right; subapical spine present or obsolete. Female gonocoxa triangular, laterally flattened, sparsely setose.

Comments. This group contains six species. One species is Holarctic whereas four are Palaearctic and one Nearctic. Larson (1989) revised the two North American species. Within this group the aedeagus may have a small but distinct subapical ventral spine (in some Palaearctic species) or the spine may be inconspicuous to obsolete. However, the existence of a spine in some members indicates a relationship with the *confinis*-group.

73. *Agabus anthracinus* Mannerheim 1852

Fig. 157A, C, D

Agabus anthracinus Mannerheim 1852: 304. Type locality - "Nov Archangelsk insulae Sitkhae".

Selected References. Larson 1989: 896 – 897; Hilsenhoff 1993*c*: 181 – 182; Larson 1997*b*: 507.

Description. Length = 6.6 to 8.1 mm; width = 3.4 to 4.2 mm; length: width = 1.82 to 2.00. Shape elongate, oval, moderately convex, lateral outline continuous.

Color mainly piceous to black. Head black except labrum, anterior margin of clypeus and frontal spots, rufous; antenna yellow basally, antennomeres 4 or 5 to 11 infuscate apically: palpi testaceous with terminal palpomere of each palpus infuscate. Pronotum black with lateral bead and disc narrowly mesad of bead, rufous to piceous. Elytron piceous to black except shoulder and lateral margin basally paler, testaceous to rufous; epipleuron piceous to black. Ventral surface of body mainly black. Legs rufous to piceous.

Sculpture of pronotum and elytron very coarse, lines deeply and broadly impressed and forming large meshes of irregular shape except laterally and apically many specimens with meshes slightly but evidently transverse; meshes smooth or with obsolete rugosity, without micropunctation; meshes with posterior margins projecting slightly so elytron has scaled appearance. Metatibia coarsely strigate.

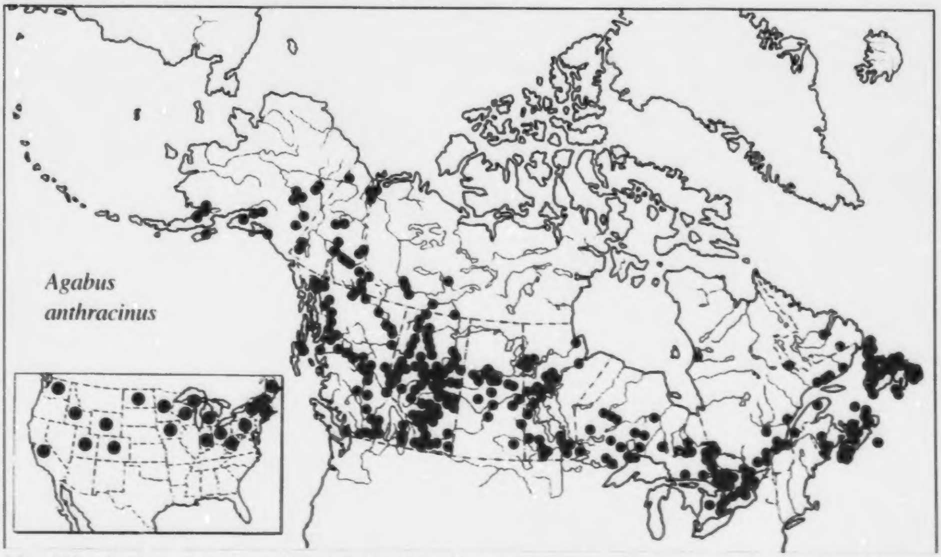
Pronotum with lateral bead of moderate width, complete. Prosternum angularly convex medially; prosternal process on slightly lower plane than prosternum, slightly but distinctly convex basally, more convex apically; apex acuminate. Width of metacoxa: width of metasternal wing = 2.53 to 3.37. Metafemur with posteroapical angle strongly produced below femoral comb, projection large and hook-shaped on males, smaller on female; metafemur length: width = 3.13 (excluding width of apical hook). Metatibia with posteroventral margin bearing a more or less complete row of separated punctures along basal half, apical half with only a few scattered punctures; medioventral face finely micropunctate.

Male protarsomeres 1 to 3 moderately dilated, protarsal ratio = 2.04:1.97:1.60:1.20:1; protarsomeres 1 to 3 conjointly bearing 10 to 12 large round scales on ventral surface and a few small adhesive setae along lateral margins; protarsal claws (Fig. 157A) narrow, anterior claw slightly longer than posterior, ventral margin almost straight, dorsal margin slightly and evenly curved; posterior claw about one-half width of anterior. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.75. Paramere stylate; aedeagus (Fig. 157C, D) relatively small in relation to size of body; basal apodemes large; shaft in lateral aspect strongly curved basally, slightly sinuate apically, in dorsal aspect apex abruptly curved to right, subapical ventral spine lacking.

Ecology. This is the most abundant species of *Agabus* in permanent lentic habitats within the boreal zone. The beetles are usually in dense emergent vegetation, often where the water is cold. Although sometimes found in association with sphagnum moss, the beetles are not typical inhabitants of bog pools but are generally in more eutrophic sites where sedges predominate. Larvae occur in spring and early summer, with teneral adults appearing in July and August. No records of flight have been seen although Hilsenhoff (1986) postulates flight to and from overwintering sites.

Distribution. Map 186. This is one of the most widely distributed North American species of *Agabus*. It ranges throughout the boreal zone, south in the east to West

Virginia, and in the west, south at higher elevations to California, southern Utah and northern Colorado. The species is generally found in forested country, northern prairie records are based mainly on single specimens.



Map 186. *Agabus anthracinus* Mannerheim. Canadian and Alaskan collection localities and United States state records.

74. *Agabus arcticus* (Paykull 1798)

Figs. 156; 157B, E, F

Dytiscus arcticus Paykull 1798: 201. Type locality - "Habitat in aquis Lapponiae Tornoensis".

Selected References. Larson 1989: 899 – 901; Nilsson and Holmen 1995: 108 – 109; Larson 1997*b*: 507.

Description. Length = 6.4 to 8.0 mm; width = 3.2 to 4.2 mm; length: width = 1.82 to 2.08. A moderately small, elongate-oval species (Fig. 156) with color pattern somewhat like a *Rhantus* species.

Head black with frontal spots, clypeus, labrum and mouthparts, testaceous; antenna testaceous basally, antennomeres 3 or 4 to 11 infuscate; palpi testaceous, terminal palpomere of each palpus infuscate apically. Pronotum yellow to pale reddish except basal and apical margins broadly bordered with black medially, these dark areas expanded and contiguous medially on disc of some specimens. Elytron brown medially, paler basally and laterally. Ventral surface mainly black. Legs reddish.

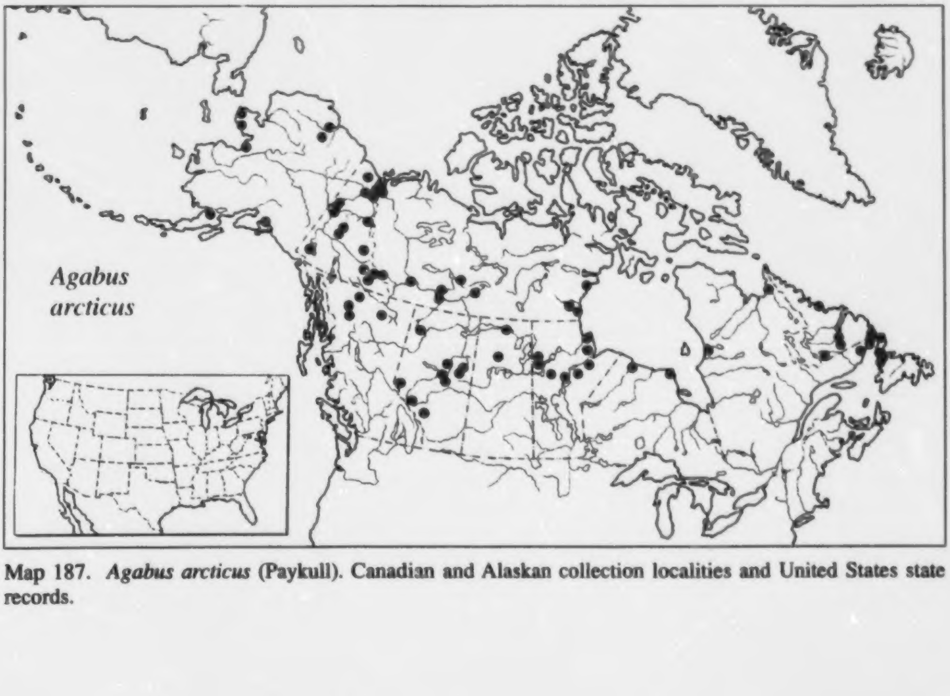
Elytron with sculpture consisting of deeply impressed lines forming coarse meshes of irregular size and shape; meshes without definite pattern of orientation, or on some specimens somewhat transverse posterolaterally; meshes smooth or with obsolete microreticulation.

Male pronotum with a narrow but complete lateral bead; female (Fig. 156) with bead on basal half to two thirds only, lateral margin sinuate towards anterolateral angle. Prosternum angularly convex medially; process flat or slightly concave basally, becoming more convex apically; apex sharply pointed. Metasternum with anteromedial emargination extending posteriorly to level of hind margin of mesocoxal cavities. Metasternal wing moderately broad, Width of metacoxa: width of metasternal wing = 2.26 to 3.19. Metafemur length: width = 3.04, posteroapical angle not produced. Metatibia with a complete row of separated punctures along posteroventral margin, mesal surface impunctate.

Male protarsomeres moderately dilated, protarsal ratio = 2.42: 2.33: 1.78: 1.25: 1; protarsomeres 1 to 3 conjointly bearing four transverse rows of large, round scales on ventral surface plus a row of very small scales basally on protarsomere 1; anterior protarsal claw (Fig. 157B) shorter than posterior, with a broad medioventral tooth; posterior claw sinuate basally. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.84. Aedeagus (Fig. 157E, F) with basal apodemes very large; shaft twisted to right in dorsal aspect, apex with a subapical dorsal ridge.

Ecology. These beetles occur in shallow water along the margins of permanent ponds and lakes. They are generally found where the substrates are firm and clean, generally clay, sand or gravel, but sometimes firm peat, and relatively free of plant debris although rooted plants, usually sedges, are present. The larval stages are known (Nilsson 1980). Generally, adults overwinter. Eggs laid in the spring hatch into larvae which complete development and pupate in mid to late summer. However, there is evidence that at high latitudes larvae not completing growth in one summer overwinter and pupate the following spring (Nilsson 1986*a*).

Distribution. Map 187. The species is Holarctic. In North America the range extends across the continent in the low arctic and northern boreal zone, from Newfoundland to western Alaska.



Map 187. ***Agabus arcticus*** **(Paykull). Canadian and Alaskan collection localities and United States state records.**

Agabus lutosus-group

Fig. 158

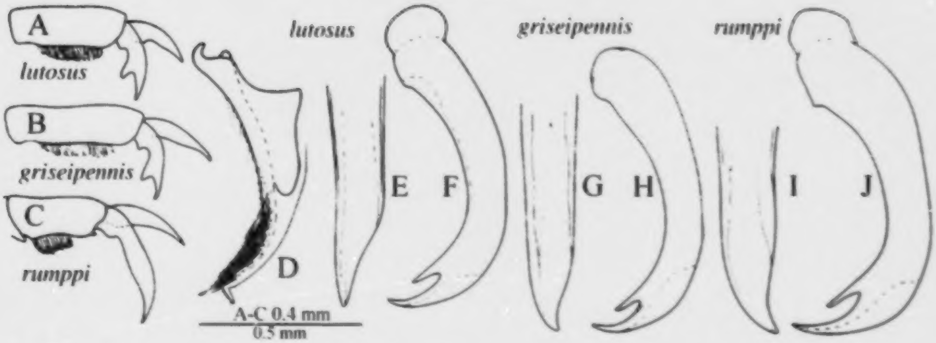


Fig. 158. *Agabus lutosus*-group. A – C - male protarsal claws, anterior. A - *A. lutosus*. B - *A. griseipennis*. C - *A. rumppi*. D – F - *A. lutosus*. D - paramere. E - aedeagus, dorsal. F - aedeagus, lateral. G – H - *A. griseipennis*. G - aedeagus, dorsal. H - aedeagus, lateral. I – J - *A. rumppi*. I - aedeagus, dorsal. J - aedeagus, lateral.

Diagnosis. Medium to large species, length = 6.4 to 9.7 mm. Habitus various, body elongate- oval with lateral margin of pronotum and elytra more or less continuous. Head and pronotum mainly black, elytra yellow to brown, at least laterally, and contrasting with forebody; epipleuron yellow. Sculpture of elytron sexually dimorphic, male with meshes small and rounded but with some irregularity in size and shape, punctation lacking from lines, small punctures present on meshes; female elytron with very coarse, convex meshes which are longitudinal in shape at least basomedially. Metafemur with fine, oblique strioles. Clypeus with anterior bead complete. Prosternal process in lateral aspect in more or less same plane as midline of prosternum; process with lateral bead narrow; process rather narrow, apex sharply pointed and received into anteromedial impression of metasternum which extends posterad to level of hind margin of mesocoxal cavities. Metasternal wings of moderate width. Metatibia with punctation of posteroventral margin various, on most specimens punctures restricted to basal third; medioventral face impunctate; metatibial spur slightly shorter than metatarsomere 1; metatarsomeres lacking ventral and dorsal accessory punctures.

Male protarsomeres 1 to 3 strongly dilated, ventrally bearing numerous, small, ovate to subquadrate, eccentrically-stalked suckers; protarsomere 5 ventrally with anterior row of short, stiff setae well developed; protarsal claws (Fig. 158A – C) modified, dissimilar in shape, anterior claw with a ventromedial angulation or a strong ventral tooth. Mesotarsus elongate, mesotarsomere 4 ventrally with posterior row of setae elaborated into a dense brush. Paramere (Fig. 158D) with basal sclerite ovate, apex elongate and setose medially and ventrally. Aedeagus (Fig. 158E – J) apex with a strong subapical, ventral spine, apex bent slightly to right in dorsal aspect. Female gonocoxae triangular, lightly sclerotized, setose.

Comments. The three species of this group are restricted to western North America (Larson 1994*a)*.

75. *Agabus lutosus* LeConte 1853

Fig. 158A, D – F

A. discolor LeConte 1852. Type locality - California. [not *A. discolor* (Harris 1828)].

Agabus lutosus LeConte 1853*a*: 31. New name for *A. discolor* LeConte.

Selected Reference. Larson 1994*a*: 138 – 140.

Description. Length = 6.4 to 8.4 mm; width = 3.4 to 4.4 mm; length: width = 1.75 to 2.03. Body elongate oval, somewhat depressed, many males with point of maximum width near base of elytra and farther anterior than typical in genus.

Head black with frontal spots and anterior margin of clypeus, rufous; labrum testaceous; antenna testaceous basally, antennomeres 4 or 5 to 11 infuscate apically; palpi testaceous, terminal palpomere of each palpus infuscate apically. Pronotum black with lateral margin narrowly rufous, width of rufous area subequal to width of lateral bead and sharply delimited against black of disc; posterior margin piceous. Elytron with lateral and basal margins testaceous, disc darkened, brown to brownish-piceous medially and apically; epipleuron testaceous. Ventral surface, including head, black with metacoxal processes and hind margins of sterna 3 to 6, rufous. Legs rufous with coxae and femora basally and ventrally piceous to black.

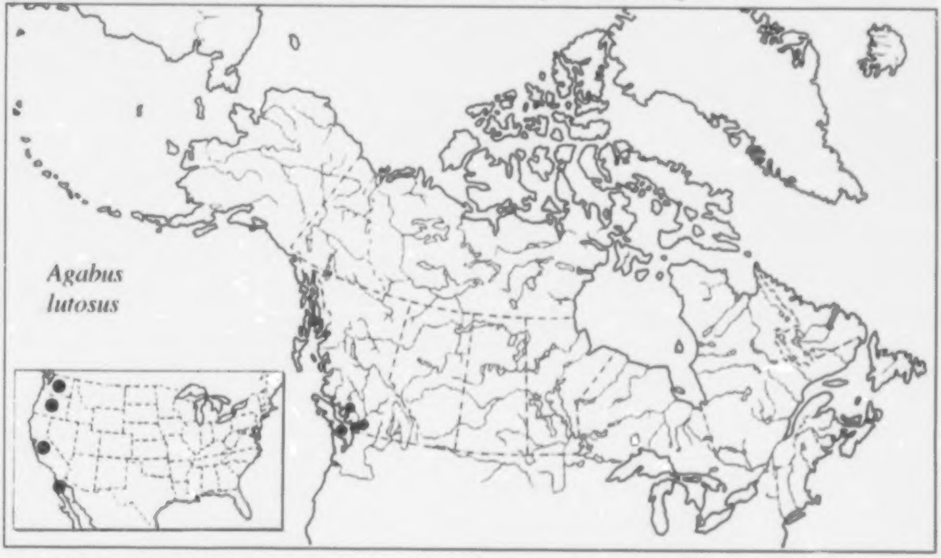
Head with lines of sculpture deep, forming large meshes of irregular size and shape; meshes smooth with sparse, fine punctures. Male pronotum with lines of sculpture moderately deep, meshes of irregular size and shape, medially distinctly longitudinally stretched, smooth with very irregular sparse punctation; female with lines deeper, meshes larger and very strongly longitudinal on medial portion of disc, irregular laterally, meshes smooth with sparse fine punctures. Elytron with sculpture sexually dimorphic: male with sculpture consisting of small, somewhat rounded or hexagonal meshes of various sizes, especially basomedially, elytron laterally and apically with numerous small punctures, each situated on an enlarged mesh; female with lines of sculpture coarse, deeply impressed and forming strongly convex meshes medially, these meshes on basal two thirds narrow and strongly longitudinally stretched, apically meshes becoming smaller and more irregular in orientation, laterally, especially along basolateral convexity, meshes small and rounded except near and just distad of middle meshes longitudinally stretched; meshes with surface irregular but without distinct microreticulation. Metacoxal plate with strong longitudinal lines, spaces between lines with fine, irregular, microreticulation. Abdominal sterna with aciculate sculpture, interspaces with partly effaced fine microreticulation. Metafemur with strioles.

Pronotum with lateral bead sharply delimited, narrow and of uniform width except narrowed on anterolateral angle making lateral margin slightly sinuate; disc mesad to bead flat or broadly and faintly convex; posterolateral angle slightly produced, hind margin broadly and more or less evenly rounded. Prosternal process narrow, acuminate apically; dorsal surface strongly and smoothly convex, less so basally; sparsely and finely punctate. Width of metacoxa: width of metasternal wing = 1.90 to 2.86. Metafemur length: width = 3.10 to 3.50. Metatibia with posteroventral margin lacking punctures or with a few punctures on basal third; medioventral face with small punctures on basal quarter to third otherwise surface impunctate or with fine micropunctation of various density.

Male protarsus broadly dilated, width protarsomere 2 = 0.23 to 0.32 mm, protarsal ratio = 3.04: 3.06: 2.65: 1.35: 1; protarsomeres 1 to 3 each bearing rounded to subquadrate scales beneath; protarsal claws (Fig. 158A) short, anterior protarsal claw with dorsal margin smoothly arcuate, ventral margin with a large tooth, axis of tooth directed at about 60° to axis of apex of claw. Mesotarsus with mesotarsomere 5 relatively short and slightly arcuate in lateral aspect; mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.43 to 0.58. Aedeagus (Fig. 158E, F) with a subapical ventral spine.

Ecology. These insects occur amongst emergent plants at the margins of ponds and quiet, depositional areas of slow, warm streams. The beetles are usually in open, sun-warmed sites.

Distribution. Map 188. The range extends along the Pacific Coast from the southwestern British Columbia mainland and Vancouver Island to Baja California, and inland to the east slope of the Sierra Nevada Mountains of California and Nevada, and the eastern slopes of the Cascade range of Washington and Oregon.



Map 188. Agabus lutosus LeConte. Canadian and Alaskan collection localities and United States state records.

76. *Agabus griseipennis* LeConte 1859

Fig. 158B, G, H

Agabus griseipennis LeConte 1859*a*: 5. Type locality - Fort Laramie, Wyoming.

Selected Reference. Larson 1994*a*: 140 – 142.

Description. Length = 6.8 to 8.9 mm; width = 3.7 to 4.6 mm; length: width = 1.76 to 2.03. Body form similar to *A. lutosus*.

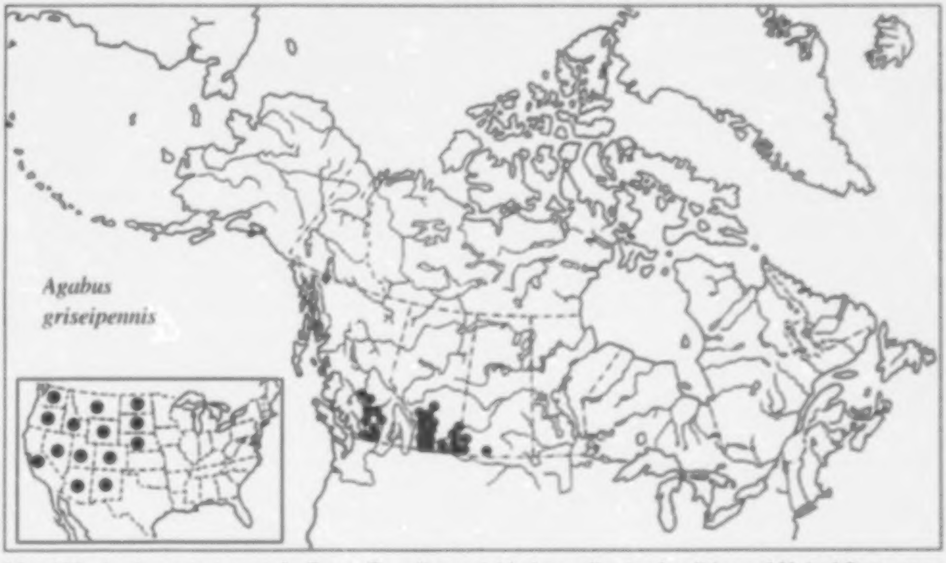
Very similar to *A. lutosus*, only points of difference listed here. Size slightly larger on average, shape slightly more elongate. Color of elytra tending to be paler, yellow basally and laterally, grading to brown medially and apically.

Male elytral sculpture similar to that of *A. lutosus*; female elytron basomedially with coarse meshes less elongate, some specimens with meshes only slightly longer than wide but most specimens with at least a few meshes strongly longitudinally stretched. Ratio width of metacoxa: width of metasternal wing slightly greater, = 1.97 to 2.88.

Male with protarsomeres 1 to 3 broadly dilated, more strongly so than in *A. lutosus*, width protarsomere 2 = 0.29 to 0.40 mm; protarsal ratio = 3.42: 3.52: 3.05: 1.43: 1; each bearing oval scales beneath; protarsal claws (Fig. 158B) short, anterior claw strongly bent basally, with a subapical ventral tooth, tooth directed apically with claw appearing almost bifid. Mesotarsus with mesotarsomere 5 elongate, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.58 to 0.85 mm. Aedeagus (Fig. 158G, H) similar to that of *A. lutosus*, with a subapical ventral spine.

Ecology. Larson (1975) reported the species from small, slow-flowing streams and isolated pools in the beds of intermittent streams in grassland areas of southern Alberta. Leech (1942*b)* stated the species also occurs in "brackish water, especially the shallow weedy shores of lakes".

Distribution. Map 189. The range extends along the Rocky Mountains from New Mexico to southern Alberta and British Columbia, and west to the eastern edge of the Cascade Range and Sierra Nevada Mountains.



Map 189. *Agabus griseipennis* LeConte. Canadian and Alaskan collection localities and United States state records.

77. *Agabus rumppi* Leech 1964
Fig. 158C, I, J

Agabus rumppi Leech 1964: 79 – 82. Type locality - 2.7 mi. E Death Valley Junction (Inyo Co.), California.

Selected Reference. Larson 1994*a*: 142 – 144.

Description. Length = 7.8 to 9.7 mm; width = 4.0 to 5.2 mm; length: width = 1.81 to 1.96. Relatively large and broadly ovate.

Head black with anteromedial portion of clypeus and a pair of frontal spots, rufous; ventral surface including mentum and ligula black to piceous; antenna yellow, outer antennomeres very faintly infuscate apically; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum black with lateral bead and anterior and posterior margins narrowly rufous, translucent. Elytron reddish brown, shoulder and epipleuron paler. Ventral surface mainly black. Legs reddish with femora, at least medially and ventrally, darkened, brown to piceous.

Sculpture sexually dimorphic. Male elytron with meshes very small, rounded but of varied size and shape, many distinctly enlarged with a medial puncture; metacoxal plate with strong longitudinal lines, interspaces with irregular microreticulation; metafemur with a few short, fine strioles. Female elytron with lines deep forming convex meshes which strongly longitudinally stretched on basomedial half, laterally more rounded, apex of elytron with lines fine and shallow and sculpture similar to that of male.

Pronotum with lateral bead sharply defined, about one half width of a middle antennomere. Pronotum with basal margin broadly semicircular except slightly sinuate near weakly produced posterolateral angle. Prosternum medially longitudinally convex, convexity continuous onto narrow prosternal process, process acuminate, narrowly margined laterally. Width of metacoxa: width of metasternal wing = 2.59 to 2.87. Metafemur length: width = 2.92 to 3.32. Metatibia with posteroventral margin bearing a few punctures along basal one-quarter to one-half, mesal face with a few coarse basal punctures and some specimens with micropunctures mainly situated on basal half.

Male protarsomeres 1 to 3 relatively broadly dilated but with considerable variation between individuals, width protarsomere 2 = 0.25 to 0.43 mm; protarsal ratio = 2.75 (2.31 to 3.43): 2.74 (2.31 to 3.43): 2.41 (1.92 to 3.00): 1.30 (1.17 to 1.43): 1; protarsomeres 1 to 3 ventrally bearing a medial group of large ovate scales fringed laterally with very small stalked adhesive setae; protarsomere 5 short, with an anteroventral lobe which bears a short comb of stiff setae, posterior row of ventral setae short with only a few small setae near base; protarsal claws (Fig. 158C) dissimilar, anterior claw longer than metatarsomere 5, dorsal margin more or less straight in basal half then evenly arcuate to apex, ventral margin with a deep basal notch, more or less expanded medially, in some specimens forming a very obtuse tooth then narrowing evenly to acute apex; posterior claw about two-thirds length of anterior, more or less evenly arcuate and narrowed to acuminate apex; claws in dorsal aspect sinuate basally. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.62 to 0.73; mesotarsal claws broadened basally in lateral aspect. Aedeagus (Fig. 158I, J) relatively stout, in dorsal aspect apex twisted to right, in lateral aspect subapical spine very slender.

Ecology. Specimens have been collected from both saline and freshwater as well as from a small intermittent stream.

Distribution. The species has a limited distribution in the southwestern United States, known from only a few localities in southeastern California, adjacent Nevada, and western New Mexico.

Agabus obsoletus-group
Fig. 159

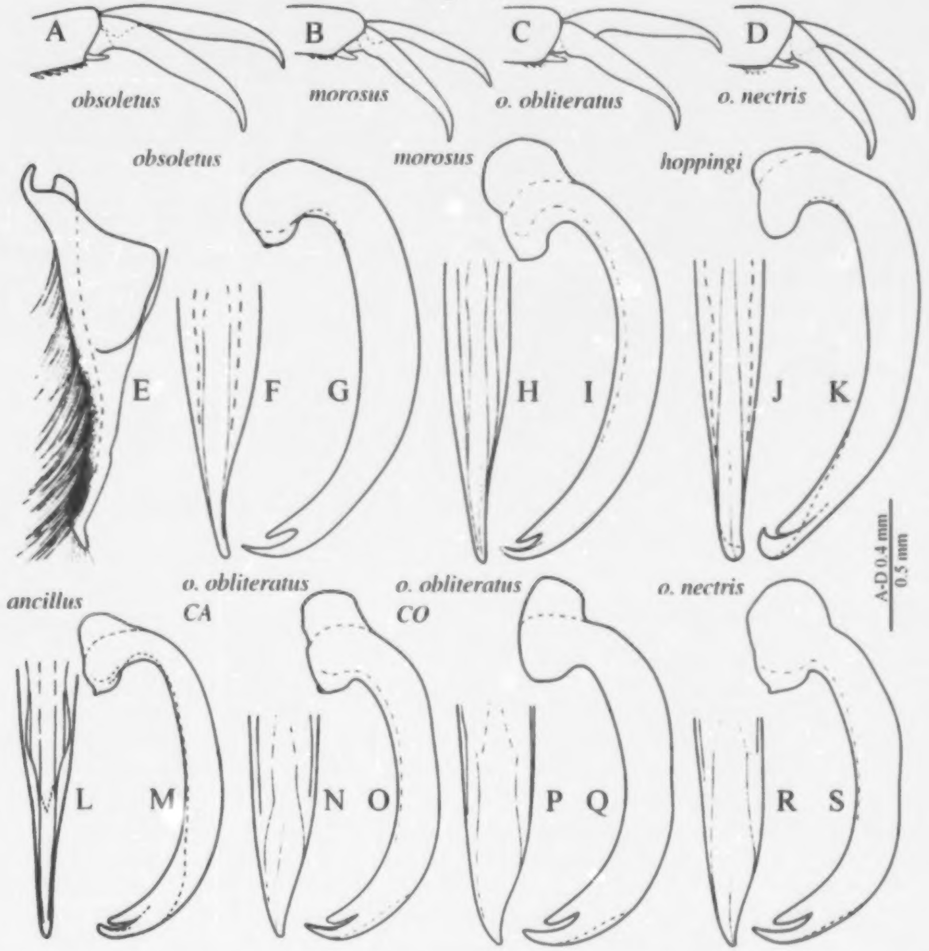

A
B
C
D
obsoletus
morosus
o. obliteratus
o. nectris
obsoletus
morosus
hoppingi
E
F
G
H
I
J
K
A-D 0.4 mm
0.5 mm
ancillus
o. obliteratus
CA
o. obliteratus
CO
o. nectris
L
M
N
O
P
Q
R
S

Fig. 159. *Agabus obsoletus*-group. A – D - male protarsal claws, anterior. A - *A. obsoletus*. B - *A. morosus*. C - *A. o. obliteratus*. D - *A. obliteratus nectris*. E – G - *A. obsoletus*. E - paramere. F - aedeagus, dorsal. G - aedeagus, lateral. H – I - *A. morosus*. H - aedeagus, dorsal. I - aedeagus, lateral. J – K - *A. hoppingi*. J - aedeagus, dorsal. K - aedeagus, lateral. L – M - *A. ancillus*. L - aedeagus, dorsal. M - aedeagus, lateral. N – Q - *A. o. obliteratus*. N, P - aedeagus dorsal. O, Q - aedeagus lateral (CA - California specimens, CO - Colorado specimen). R - S - *A. obliteratus nectris*. R - aedeagus, dorsal. S - aedeagus, lateral.

Diagnosis. Small to medium sized species, length = 5.8 to 8.5 mm. Habitus elongate-oval, lateral outline in dorsal aspect continuous or most specimens with posterolateral angles of pronotum somewhat rounded and body outline slightly to distinctly discontinuous. Head and pronotum mainly black, elytra yellow to brown, at least laterally, and on most specimens contrasting with forebody; epipleuron mainly piceous to black. Sculpture of elytron with meshes very irregular in size and shape, sexually dimorphic with female bearing very coarse, granular meshes (very rarely female with male-like sculpture). Metafemur without strioles. Clypeus with anterior bead complete but very narrow. Prosternal process in lateral aspect stepped down from midline of prosternum and in a distinctly lower plane; process with lateral bead narrow, apex sharply pointed and received into anteromedial impression of metasternum. Metatibia with punctation of posteroventral margin various, on most specimens punctures restricted to basal third; medioventral face impunctate or micropunctate; longer metatibial spur slightly shorter than metatarsomere 1; metatarsomeres lacking ventral and dorsal accessory punctures. Male protarsomeres 1 to 3 strongly dilated, ventrally bearing numerous ovate, eccentrically-stalked suckers; protarsomere 5 ventrally with a pair of apically converging rows of short, stiff setae; protarsal claws (Fig. 159A - D) elongate, slightly sinuate ventrally. Paramere (Fig. 159E) stylate; aedeagus (Fig. 159F - S) apex with a strong subapical spine, apex bent slightly to right or almost straight. Female gonocoxae triangular, lightly sclerotized, setose.

Comments. These insects are mainly lotic, usually occurring in depositional areas with emergent grasses and sedges in springs, at the margins of small streams and in pools in intermittent streams. This group of five species is endemic to western North America, from southern Canada to northern Mexico. The group was revised by Larson (1994*a*).

78. *Agabus obsoletus* LeConte 1858

Fig. 159A, E – G

Agabus obsoletus LeConte 1858: 15. Type locality - San Diego, California.

Selected Reference. Larson 1994*a*: 146 – 147.

Description. Length = 6.5 to 8.5 mm; width = 3.6 to 4.5 mm; length: width = 1.76 to 2.00. Relatively large and robust species for group; lateral margin of pronotum slightly incurved at base and slightly discontinuous with curvature of elytral margin.

Head black except large frontal spots and narrow anterior margin of clypeus, rufous, ventral surface black; antenna yellow basally, antennomeres 4 or 5 to 11 lightly infuscate apically; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum with disc black, lateral bead and disc mesad of bead very narrowly rufous. Elytron reddish brown basally and laterally, disc medially and apically reddish brown to piceous; epipleuron piceous to black except outer margin narrowly rufous. Ventral surface mainly black. Front and middle legs reddish with femora and mesotibia darkened; hind legs rufopiceous to piceous.

Sculpture sexually dimorphic. Male elytron with lines fine, forming small meshes of very unequal sizes and irregular shapes, meshes generally smaller than diameter of impressions of serial punctures, some intersections of lines with a small puncture; meshes smooth, without microreticulation. Female elytron with lines of sculpture much deeper, meshes subgranular, bearing irregular lines and impressions. Metacoxal plate with irregular, somewhat elongate meshes.

Pronotum with lateral bead sharply delimited from disc, about one half maximum width of a middle antennomere, bead in lateral aspect not strongly broadened on anterolateral angle; posterolateral angle slightly produced, about right angled except narrowly rounded apically; base shallowly but distinctly bisinuate each side of middle. Prosternum with process distinctly stepped down from midline of prosternum; prosternum medially longitudinally convex, broadest anteriorly becoming narrower and more or less carinate between procoxae; process flat basally, becoming more convex apically especially in apical half, apex acuminate; lateral bead narrow. Width of metacoxa: width of metasternal wing = 2.35 to 3.33. Metafemur clavate, length: width = 2.66 to 3.25. Metatibia with a row of small separated punctures along basal third of inner margin; ventral face impunctate except for a small group of punctures at base, and some specimens with very minute micropunctures.

Male protarsomeres 1 to 3 moderately broadly dilated, mean width protarsomere 1 = 0.26 mm, protarsal ratio = 2.45: 2.15: 1.75: 1.10: 1; protarsal claws (Fig. 159A) elongate, similar in shape and length, in lateral aspect slightly widened medially, ventral margin gently sinuate, apex arcuate and sharply pointed. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.51 to 0.61; mesotarsal claws slender. Paramere stylate (Fig. 159E). Aedeagus (Fig. 159F, G) in dorsal aspect evenly narrowed in apical half to apex which is slightly flattened laterally and sharply pointed, apex slightly twisted to right; in lateral aspect ventral surface flat in medial half, apex recurved to level of axis of subapical spine; subapical spine narrow, acute.

Ecology. Most collection records are from vegetation-rich depositional areas of springs and small streams although specimens have also been collected from saline and freshwater lakes.

Distribution. The range extends along the Pacific coast from Baja California to the vicinity of San Francisco Bay, and inland in southern California to Inyo County and extreme southwestern Nevada.

79. *Agabus morosus* LeConte 1852

Fig. 159B, H, I

Agabus morosus LeConte 1852: 204. Type locality - San Francisco, California.

Selected References. Fall 1922: 24; Leech 1942*b*: 135 – 136; Leech and Chandler 1956: 321; Larson 1994*a*: 147 – 149.

Description. Length = 6.1 to 7.3 mm; width = 3.0 to 3.9 mm; length: width = 1.81 to 2.00. Shape elongate.

Head black except frontal spots and anterior margin of clypeus, rufous; ventral surface black with mentum piceous, ligula and rest of mouthparts yellow; antenna yellow basally, antennomeres 4 or 5 to 11 infuscate apically; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum with disc black, lateral bead and margin of disc subequal to width of bead, rufous. Elytron reddish brown to piceous, palest basally and laterally; epipleuron black, most specimens with outer margin narrowly rufous. Ventral surface mainly black with proepipleuron, at least anteriorly and laterally, prosternal process apically, metacoxal processes and apical margin of sterna 3 to 6, rufous. Legs reddish with femora medially and ventrally piceous.

Sculpture sexually dimorphic. Male head with lines of sculpture fine, forming small meshes of irregular size and shape, indistinct punctures at intersections of some of the lines, some meshes with a small puncture; pronotum with sculpture similar but lines deeper especially laterally and basally, meshes larger, some slightly longitudinally stretched, laterally meshes smaller and more granular; elytron with meshes small but very irregular in shape and size, most pronouncedly so basally and medially, many intersections of lines with a small puncture. Female with lines deeper and meshes larger and more convex; pronotum with strongly longitudinal meshes medially; elytron with meshes slightly convex, slightly longitudinal in orientation at least basomedially on disc; apical one-fifth with sculpture similar to that of male.

Pronotum with lateral bead well delimited from disc, width about one half width of a middle antennomere; in lateral aspect of about same width throughout length or only shortly broadened on anterolateral angle; posterolateral angle narrowly rounded, right angled to slightly obtuse; basal margin slightly sinuate each side of middle but only very slightly concave mesad of anterolateral angle. Prosternum with a strong median longitudinal convexity, this ending abruptly on neck of process which is evidently stepped down to lower plane than midline of prosternum; process broadly convex to almost flat basally, more strongly but smoothly convex apically; surface with sparse fine setose punctures, lateral bead narrow, in lateral aspect sinuate posterad of procoxae. Metasternal wing of moderate width, width of metacoxa: width of metasternal wing = 2.23 to 3.00. Metafemur length: width = 2.93 to 3.33. Metatibia with a few small, separated punctures along basal third to half of posterior margin; mesal face impunctate or with almost imperceptible micropunctures on some specimens.

Male protarsomeres 1 to 3 moderately dilated, mean width protarsomere 1 = 0.25 mm, protarsal ratio = 2.50: 2.16: 1.72: 1.09: 1; protarsal claws (Fig. 159B) subequal in width, similar in shape but posterior claw with ventral margin more distinctly sinuate and more concave basally, apex evenly curved. Mesotarsomere 5 length: combined length mesotarsomeres1 to 4 = 0.49 to 0.56. Aedeagus (Fig. 159H, I) in dorsal aspect with apex almost straight or slightly curved to right, evenly narrowing to pointed apex; in lateral aspect ventral margin not distinctly flattened.

Ecology. Label data indicate occurrence in springs and creeks.

Distribution. The range is along the coast of California from San Francisco Bay area north to northern California and southwestern Oregon.

80. *Agabus hoppingi* Leech 1942

Fig. 159J, K

Agabus hoppingi Leech 1942*b*: 135. Type locality – Gray Meadow, Tulare Co. California.

Selected Reference. Larson 1994*a*: 149 – 150.

Description. Length = 6.80 to 7.70 mm; width = 3.55 to 4.00 mm; length: width = 1.80 to 1.98.

Head black except frontal spots and anterior margin of clypeus, rufous; ventral surface black except mouthparts rufous; antenna yellow basally, antennomeres 4 or 5 to 11 lightly infuscate apically; palpi yellow or some specimens with apical palpomere of each palpus lightly infuscate apically. Pronotum with disc black, lateral bead and margin of disc mesad to bead narrowly rufous, width of rufous area subequal to width of a middle antennomere, anterior and basal margins faintly rufescent. Elytron reddish brown to piceous, palest basally and laterally; epipleuron piceous to black except outer margin narrowly rufous. Ventral surface mainly black except proepipleuron anteriorly, prosternal process apically and posterior margin of abdominal sterna 3 to 6, rufous. Legs rufous with femora darkened at least medially and basally, many specimens with metatibia somewhat darkened.

Sculpture sexually dimorphic. Male elytron with lines fine, meshes for most part small and rounded with interspersed larger meshes, small punctures present both in some meshes and at intersections of some lines. Female with basal two-thirds to three-quarters of disc with deep lines forming coarse, somewhat convex granular meshes which are of irregular size and shape except at least basomedially with a slight longitudinal stretching of at least some meshes.

Pronotum dorsally with lateral bead evenly and gradually widened from base to anterolateral angle, less distinctly delimited from disc anteriorly, in lateral aspect bead narrow basally but strongly dilated anterad of middle, especially on ventral surface; basal margin more or less evenly semicircular with a slight sinuation mesad of slightly obtuse posterolateral angle. Prosternum tectiform, median convexity narrowly rounded; prosternal process slightly but distinctly stepped down, less convex basally than prosternum but generally lowly and evenly convex throughout its length, lateral bead narrow in lateral aspect, not abruptly ascending medially on process. Width of metacoxa: width of metasternal wing = 2.46 to 3.36. Metafemur length: width = 2.94 to 3.25. Metatibia with a few small punctures along basal third to half of posteroventral margin; ventral face impunctate.

Male protarsi moderately dilated, mean width protarsomere 1 = 0.23 mm, protarsal ratio = 2.14: 1.92: 1.54: 1.10: 1.0; protarsal claws subequal, similar in shape but posterior claw more strongly sinuate beneath and more deeply concave basally. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.57. Aedeagus (Fig. 159J, K) slender, more or less evenly arcuate along length, in lateral aspect with apex shortly but abruptly hooked, inner side of hook with an impression so that apex forms a hood over apex of subapical spine; aedeagus in dorsal aspect straight and not asymmetrically curved.

Ecology. The species is likely lotic like other members of the group. The probable habitat is areas of emergent vegetation growing in silt in springs and depositional areas along the margins of small streams.

Distribution. This species is known only from the Sierra Nevada Mountains of California.

81. *Agabus ancillus* Fall 1922

Fig. 159L, M

Agabus ancillus Fall 1922: 24 – 25. Type locality - Gaston, Oregon.

Selected Reference. Larson 1994*a*: 150 – 151.

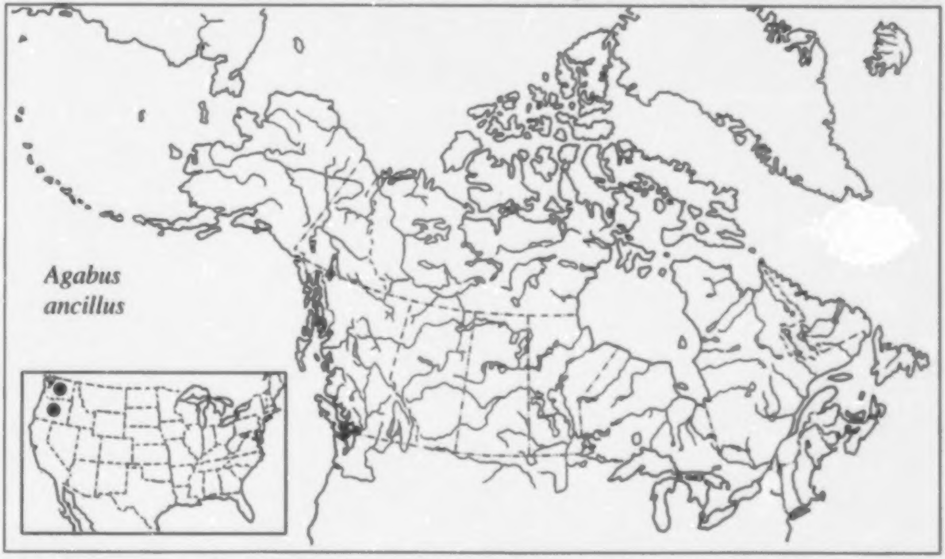
Description. Length = 5.8 to 6.7 mm; width = 2.96 to 3.48 mm; length: width = 1.87 to 2.00. Smallest species of group; shape elongate, with a slight discontinuity in lateral curvature between pronotum and elytra.

Head black except a pair of large frontal spots, rufous; ventral surface black; antenna yellow basally, antennomeres 4 or 5 to 11 lightly infuscate apically; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum with disc black, lateral bead, at least anteriorly, rufous, some specimens with entire lateral bead and lateral margin of disc, to about width of a middle antennomere, rufous. Elytron yellow to pale brown basally and laterally, disc medially and apically darker brown to piceous; epipleuron piceous to black with outer margin narrowly yellow. Ventral surface mainly black. Legs reddish brown, femora dark brown medially.

Sculpture sexually dimorphic. Male head with small meshes of very irregular size and shape, meshes smooth medially or some with a small puncture; pronotum medially with lines a little deeper than on head, meshes slightly larger and with some tendency to longitudinal orientation, laterally lines deeper and meshes smaller and more rounded; elytron with lines fine, meshes small and very irregular in size and shape, some intersections of lines with a small puncture, metacoxal plate with small, irregular, somewhat longitudinal meshes. Female with pattern of sculpture similar but lines on pronotum and head more deeply impressed and meshes generally larger, more convex and granular and on elytron lines deep, meshes coarse and somewhat roughened medially.

Pronotum with posterolateral angle slightly obtuse, somewhat rounded apically; basal margin of pronotum faintly bisinuate each side of middle. Prosternum medially longitudinally convex, convexity ending between procoxae at base of prosternal process, process very slightly stepped down from plane of midline of prosternum, slightly convex basally, becoming more convex apically, surface finely punctate, apex acuminate; lateral bead narrow. Width of metacoxa: width of metasternal wing= 2.25 to 2.69. Metafemur slender, length: width = 2.97 to 3.42. Metatibia with posteroventral margin with usually 1 to 3 punctures in basal quarter of length but some specimens with irregularly scattered punctures along basal half; mesal surface smooth, without micropunctation, basally with a few setiferous punctures.

Male protarsus moderately dilated, mean width protarsomere 1 = 0.23 mm, protarsal ratio = 2.29: 1.96: 1.58: 1.16: 1; protarsal claws slightly elongated, subequal in length, similar in shape, narrow with ventral margin very slightly broadened medially, apex arcuate. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50.



Map 190. *Agabus ancillus* Fall. Canadian and Alaskan collection localities and United States state records.

Aedeagus (Fig. 159L, M) in dorsal aspect evenly narrowing with apical quarter very slender and parallel sided, laterally compressed including subapical spine; ventral surface basally very slightly convex.

Ecology. Specimens have been collected from a variety of habitat types including pools in highway ditches, amongst emergent sedges along stream margins and in dune ponds near the seashore.

Distribution. Map 190. The range extends along the Pacific coast, from southwestern British Columbia to northern California.

82. *Agabus obliteratus* LeConte 1859

Fig. 159C, D, N – S

Agabus obliteratus LeConte 1859*b*: 5. Type locality – Fort Laramie, Wyoming.

Agabus nectris Leech 1942*b*: 133 – 135. Type locality – Lumby, B.C.

Selected Reference. Larson 1994*a*: 151 – 153.

Description. Length = 6.4 to 7.9 mm; width = 3.4 to 4.1 mm, length: width = 1.80 to 2.00. Shape elongate.

Head black except frontal spots and anterior margin of clypeus, rufous, ventral surface black, mentum and ligula piceous; antenna yellow basally, many specimens with antennomeres 4 or 5 to 11 infuscate apically or at least apical antennomere lightly infuscate; palpi yellow, apical palpomere of each palpus infuscate apically. Pronotum with disc black, lateral bead rufous and most specimens with lateral margin of disc narrowly rufous. Elytron yellow to reddish brown basally and laterally, disc medially and apically darker, brown to piceous; epipleuron black with outer margin narrowly rufous. Ventral surface mainly black except proepipleuron anteriorly and laterally, metacoxal lobes and abdominal sterna 3 to 6 apically, rufous. Legs reddish with femora piceous to black at least medially and ventrally, and some specimens with metatibia medially darkened.

Sculpture sexually dimorphic. Male head with lines of sculpture fine, forming small meshes of irregular size and shape; pronotum with meshes larger medially, smaller and more convex laterally; elytron with lines fine, forming irregular meshes, largest basomedially, smaller apically. Female with lines of sculpture deeper on pronotum and elytron, meshes larger and more convex, on pronotum some meshes longitudinally stretched, especially medially on disc; elytron with some slight longitudinal stretching basomedially, lines finer and sculpture male-like near apex.

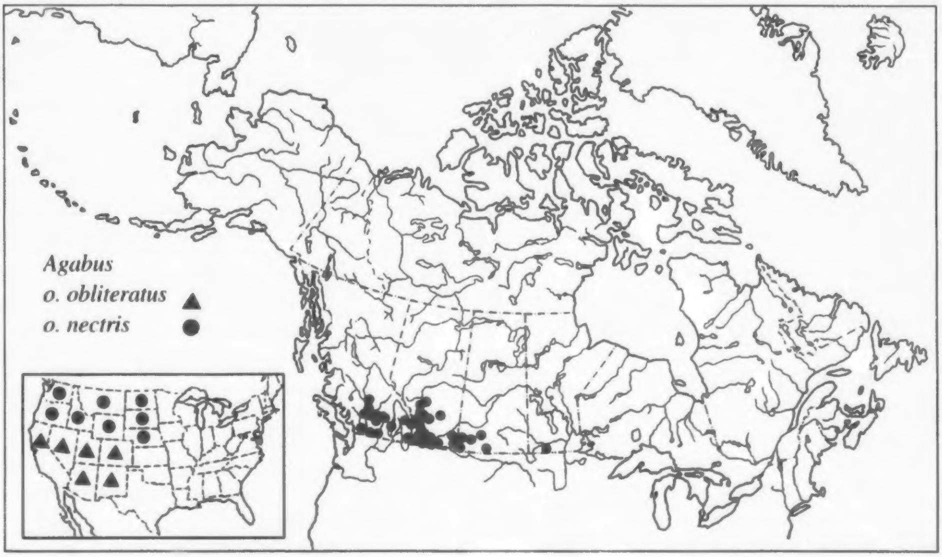
Pronotum with lateral margin more arcuate than that of basal part of elytron in dorsal aspect and therefore body distinctly discontinuous in outline, especially on male; hind angle narrowly rounded and obtuse, basal margin broadly semicircular and only slightly bisinuate each side of middle; lateral bead sharply defined, in dorsal aspect about one half width of a middle antennomere, in lateral aspect of more or less uniform width from base to at least base of anterolateral angle, slightly swollen on anterolateral angle of many specimens. Prosternum in lateral aspect with midline of medial convexity on a different plane than midline of prosternal process; process flat to broadly and evenly convex basally, more strongly convex apically, lateral bead in lateral aspect strongly arcuate, ascendant distad of middle. Width of metacoxa: width of metasternal wing = 2.12 to 3.17. Metafemur length: width = 2.94 to 3.39. Metatibia with a few isolated punctures along basal third to half of posteroventral margin; mesal face with micropunctation various, impunctate or with sparse to very dense micropunctures.

Male protarsomeres 1 to 3 distinctly dilated, mean width protarsomere 1 = 0.26 mm, protarsal ratio = 2.52: 2.21: 1.78: 1.10: 1; protarsal claws (Fig. 159C, D) elongate, subequal, posterior claw similar in shape to anterior but narrower. Mesotarsomere 5 relatively elongate, mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.53 to 0.65. Aedeagus (Fig. 159N – S) in dorsal aspect stout, with apical constriction short and apex twisted to right.

Comments. The species includes two subspecies, *A. o. obliteratus* which lacks micropunctation of the metatibia, and *A. o. nectris* Leech in which the metatibia is densely micropunctate.

Ecology. These beetles occur among emergent vegetation in depositional areas of springs and small streams, both permanent and intermittent. Less frequently, specimens have been collected from small ponds, ditches or on mineral substrates. Specimens are often found in association with *A. seriatus* Say, a characteristically lotic species.

Distribution. Map 191. The range includes the Great Basin, Rocky Mountains and northern Great Plains. The range of the nominate subspecies, *A. o. obliteratus* LeConte, extends from southern Oregon and eastern California to western Wyoming and south to Arizona and New Mexico. The subspecies *A. o. nectris* Leech is more northern with its range extending from southern British Columbia to Manitoba and south to central Oregon, northern and eastern Wyoming and Nebraska.



Map 191. *Agabus obliteratus* LeConte. Canadian and Alaskan collection localities and United States state records.

Agabus fuscipennis-group
Fig. 160

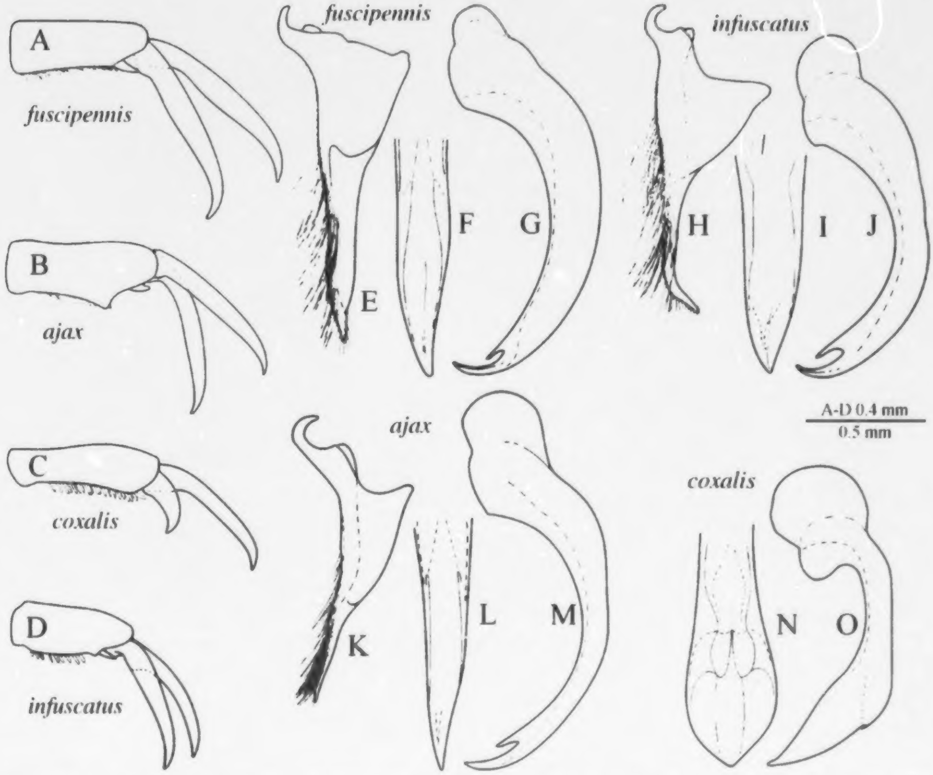


Fig. 160. *Agabus fuscipennis*-group. A – D - male protarsal claws, anterior. A - *A. fuscipennis*. B - *A. ajax*. C - *A. coxalis*. D - *A. infuscatus*. E – G - *A. fuscipennis*. E - paramere. F - aedeagus, dorsal. G - aedeagus, lateral. H – J - *A. infuscatus*. H - paramere. I - aedeagus, dorsal. J - aedeagus, lateral. K – M - *A. ajax*. K - paramere. L - aedeagus, dorsal. M - aedeagus, lateral. N – O - *Agabus coxalis*. N - aedeagus, dorsal. O - aedeagus, lateral.

Acatodes Thomson 1859: 13. Type species - *Dytiscus fuscipennis* Paykull, by original designation.

Heteronychus Seidlitz 1887: 81, 95. Type species - *Agabus coxalis* Sharp, by monotypy. Not Burmeister 1844.

Allonychus Zaitzev 1905: 39. Replacement name for *Heteronychus* Seidlitz.

Diagnosis. Medium to large species, length = 6.6 to 11.0 mm. Color various, pale brown to piceous but not black; pronotum and elytra concolorous or elytra paler than pronotum. Sculpture similar between sexes, fine, elytron with meshes small, rounded or polygonal. Metafemur with ventral face bearing small to distinct punctures but lacking strioles. Clypeus with anterior bead complete. Prosternal process carinate or tectiform in cross section, apex sharply pointed and received into well developed anteromedial impression of metasternum. Metatibia with posteroventral margin with a more or less complete row of separated punctures; longer metatibial spur shorter than metatarsomere 1.

Metatarsomere 1 lacking accessory dorsal and ventral setae. Male protarsus relatively broadly dilated, with moderate to large oval or round scales on ventral surface. Paramere stylate (Fig. 160E, H, K); aedeagus (Fig. 160G, J, M) with a subapical ventral spine present or spine secondarily lost (Fig. 160O), apex twisted to right in dorsal aspect. Female gonocoxae laterally flattened, without a lateral ridge.

Comments. The members of this group have a rather unusual life history. Overwintering occurs in the egg stage (Nilsson 1986*a)* with teneral adults first appearing in late spring or summer. Apparently all adults die in the fall. These beetles show an unusual amount of variation both in size as well as in the amount of irregularity in body structure. The four Nearctic members of the group have been revised by Larson (1994*a)*.

83. *Agabus fuscipennis* (Paykull 1798)

Fig. 160A, E – G

Dytiscus fuscipennis Paykull 1798: 209. Type locality - Vestrogothia (Västergötland), Sweden.

Selected References. Larson and Nilsson 1985: 122-124, Larson 1994*a*: 155 – 156; Nilsson and Holmen 1995: 117 – 118; Larson 1997*b*: 509.

Description. Length = 9.1 to 11.0 mm, width = 5.3 to 6.3 mm, length: width = 1.69 to 1.85. A large, broad species.

Head piceous to black except frontal spots, anterior margin of clypeus, labrum and mouthparts, rufous; antenna and palpi testaceous basally, infuscate apically. Pronotum piceous to black medially, lateral margins broadly rufous. Elytron rufous laterally, piceous to black medially and apically on disc; epipleuron reddish brown. Ventral surface piceous to black except metacoxal process and posterior margin of sterna 3 to 6, rufous. Legs dark rufous.

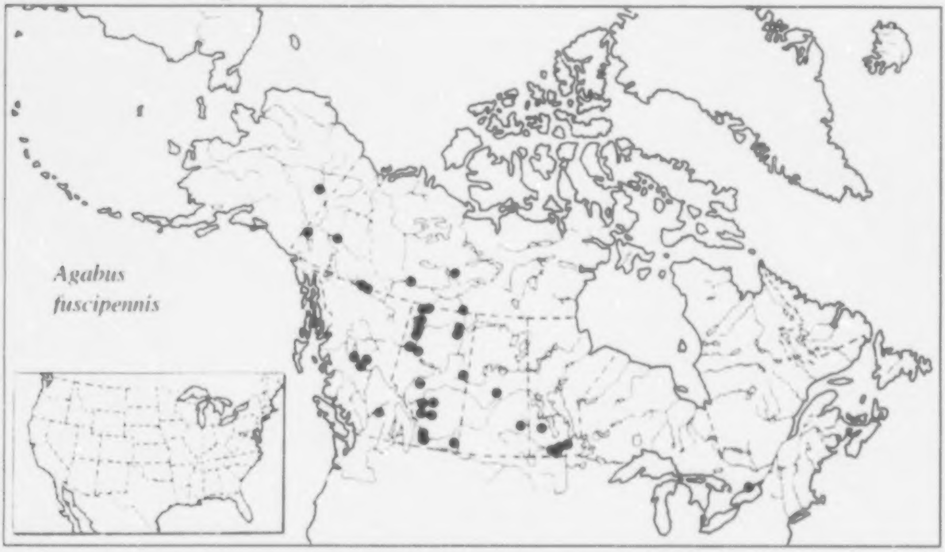
Elytron of male with meshes small, irregular in size and shape basally, more rounded and equal in size laterally and apically, smooth or with partly effaced microreticulation. Females with sculpture various, many with lines deeply impressed, meshes irregular in size and shape over much of elytron and more or less granular, with microreticulation.

Pronotum with lateral bead narrow, sharply delimited medially but on many specimens becoming obsolete towards anterolateral angle. Prosternal process narrowly and strongly convex, medial ridge narrowly rounded in cross section; apex bluntly pointed. Metasternum with anteromedial impression well developed. Width of metacoxa: width of metasternal wing = 3.40 to 3.85. Metafemur relatively slender, length: width = 3.45 to 3.77; ventral face distinctly punctate. Metatibia with posteroventral series of punctures more or less contiguous along hind margin, entire ventral face with small sparsely spaced punctures (better developed on male than female).

Male protarsus relatively broadly dilated, width protarsomere 1 = 0.40 to 0.47 mm, protarsal ratio = 2.67: 2.63: 2.23: 1.21: 1; protarsomeres 1 to 3 with moderate sized oval scales beneath; protarsomere 5 slender, without a ventral tooth; protarsal claws (Fig. 160A) slender, subequal in length, slightly sinuate ventrally. Aedeagus (Fig. 160F, G) with a subapical ventral spine, apex twisted slightly to right, basal apodemes small.

Ecology. These insects occur in deeper *Carex* marshes, in sites where dense emergent stalks shade the water and where standing water is usually present throughout the summer. Nilsson and Persson (1989) described the Scandinavian habitat as "densely vegetated parts of shallow, more eutrophic lakes and seasonally flooded river-meadows". Larval stages have been described (Galewski 1972; Nilsson 1982*b*, 1987*b*).

Distribution. Map 192. The species has a wide range within the boreal zone of the Holarctic region. In the Palaearctic, the range extends from Scandinavia to Siberia. The North American range is from Alaska to Ontario.



Map 192. *Agabus fuscipennis* (Paykull). Canadian and Alaskan collection localities and United States state records.

84. *Agabus ajax* Fall 1922

Fig. 160B, K – M

Agabus ajax Fall 1922: 30. Type locality - Waghorn, Alberta.

Selected References. Larson 1994*a*: 156 – 158; Larson 1997*b*: 507.

Description. Length = 6.6 to 10.2 mm; width = 3.8 to 5.9 mm; length: width = 1.62 to 1.83. Size moderately large but highly varied over range.

Color of body yellow brown to brown with head basally and disc of pronotum medially, dark brown to piceous; elytron dark brown with lateral, basal and scutellar margins paler; ventral surface rufous to rufopiceous. Antenna testaceous or some specimens with antennomere 11 infuscate apically; palpi testaceous with apical palpomere of each palpus infuscate apically. Legs rufous.

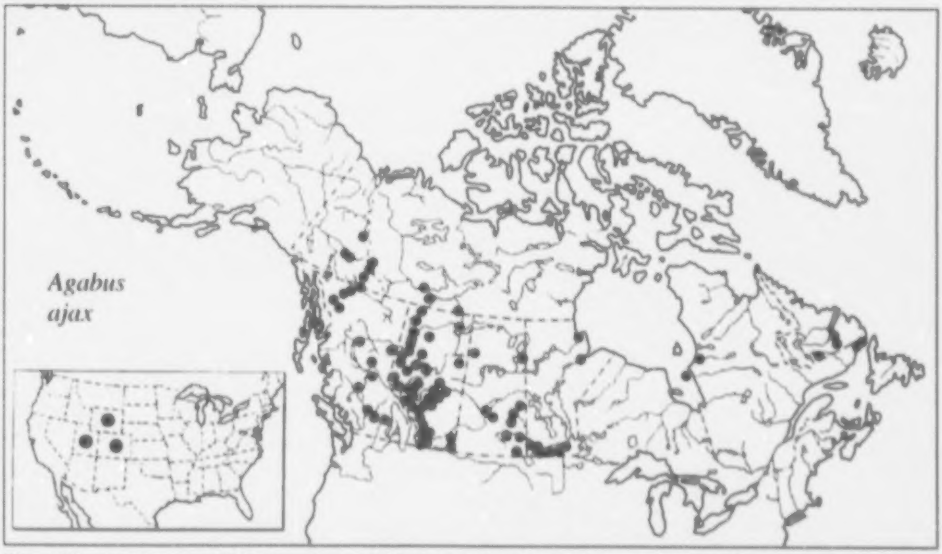
Elytron with sculpture consisting of rounded or hexagonal, more or less isodiametric meshes; meshes smooth and shiny, without microreticulation.

Pronotum with lateral bead narrow, poorly defined; disc more or less flat mesad to bead. Prosternal process strongly convex in cross section, with a narrowly rounded medial keel; process with apex slightly deflected upwards posterad to procoxae and not exactly in same plane as midline of prosternum. Width of metacoxa: width of metasternal wing = 3.08 to 4.56. Metacoxae with intralinear space not scabrous or rugose; metacoxal process with hind margin mesad to posterolateral emargination convexly arched. Metafemur length: width = 3.18 to 3.62. Metatibia with a sparse irregular row of punctures along posteroventral margin; medioventral face with small, scattered punctures.

Male protarsus broadly dilated but width varied, width protarsomere 1 = 0.36 to 0.54 mm; protarsal ratio range = 2.77-3.69: 2.33-3.20: 2.00-2.75: 1.00-1.33: 1; protarsomeres 1 to 3 together with about 20 large, oval scales on ventral surface; protarsomere 5 (Fig. 159) with a ventral tooth; protarsal claws (Fig. 160B) elongate, slender and more or less straight, anterior claw slightly sinuate along ventral margin. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.67 to 0.81. Aedeagus (Fig. 160L, M) slender, with a subapical spine.

Ecology. These insects occur in permanent boreal ponds, beaver ponds, at the margin of lakes and warmer subalpine and alpine ponds. They generally occur among emergent sedges in places where the substrate is firm and are seldom found where there is an accumulation of peat or silt. Adults appear only in late spring and summer.

Distribution. Map 193. *Agabus ajax* is the only member of the group that is exclusively Nearctic. The range extends in the boreal zone from Labrador to the Yukon Territory and south along the Rocky Mountains to Colorado.



Map 193. *Agabus ajax* Fall. Canadian and Alaskan collection localities and United States state records.

85. *Agabus coxalis* Sharp 1882

Fig. 160C, N, O

Agabus coxalis Sharp 1882*a*: 535. Type locality - Angara, east Siberia. Type - BMNH, male, no. 808, examined.

Selected References. Carr and Leech 1966: 548; Nilsson 1990: 158; Larson 1994*a*: 158 – 159; Larson 1997*b*: 508.

Description. Length = 6.7 to 9.3 mm; width = 3.8 to 5.3 mm; length: width = 1.71 to 1.87. Moderately large species but size highly varied.

Dorsal surface of body testaceous to pale brown except base of head and frons between eyes, dark brown to piceous, and pronotum with a pair of medial spots or a medial transverse bar, dark brown. Ventral surface pale brown to reddish brown, sternum 1 evidently paler than hind margin of metacoxal plates and sternum 2. Antenna and palpi testaceous, lightly infuscate apically. Legs pale.

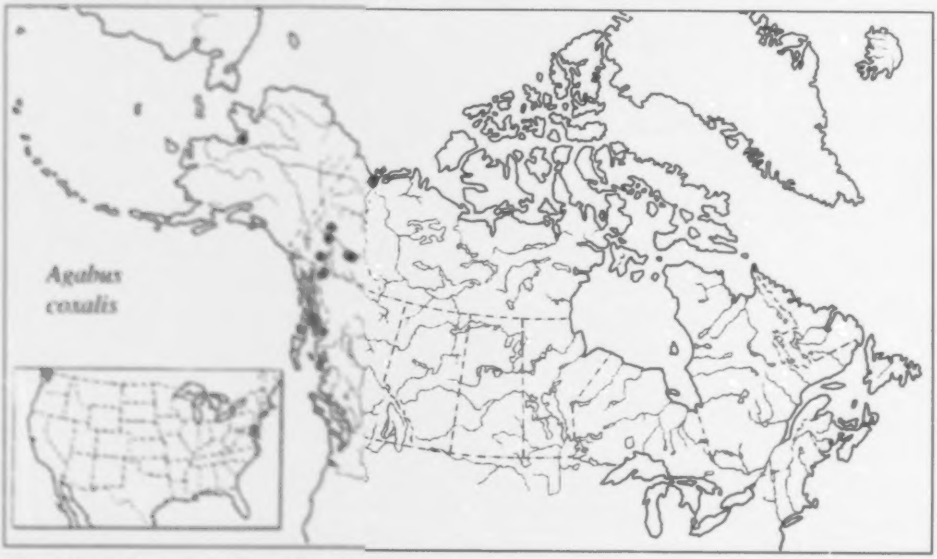
Elytron with sculpture consisting of small, flat, polygonal or somewhat rounded meshes of more or less equal size.

Clypeus with anterior bead complete. Pronotum with lateral margins little arcuate, almost straight along anterior half or with a faint sinuation on anterolateral angle of some specimens; basally as broad as elytra across shoulders and more or less continuous in outline with elytra in dorsal aspect; lateral bead of moderate width, disc mesad to bead flat or even slightly concave medially. Elytron in lateral aspect with lateral margin straight, epipleuron disappearing well posterad of shoulder. Prosternal process more or less smoothly convex in cross section, surface setose; apex sharply pointed, acuminate. Metasternal impression well developed, attaining level of hind margin of mesocoxae. Width of metacoxa: width of metasternal wing = 2.89 to 3.88; metacoxal plates with dense parallel lines forming irregular longitudinal meshes, meshes with variously effaced finer lines; intralinear space slightly punctato-rugose; metacoxa in posterior aspect with hind margin flat mesad of posteromedial emargination. Metafemur length: width = 2.88 to 3.35; metafemur with ventral face bearing fine, oblique strioles. Metatibia with scattered punctures along length of ventral face, posteroventral margin with irregular series of punctures extending most of length.

Male protarsomeres 1 to 3 broadly dilated but degree of dilation varying geographically and with length, width protarsomere 1 = 0.36 to 0.50 mm, mean protarsal ratios for two population samples: AK, Unalakleet = 3.97 : 4.04 : 3.52 : 1.33 : 1; YT, Ross River = 4.34: 4.47: 3.91: 1.32: 1; protarsomeres 1 to 3 bearing a small number of large ovate scales ventrally; protarsomere 5 not toothed ventrally; anterior protarsal claw (Fig. 160C) short, less than one half length of posterior claw, broad with apex shortly arcuate; posterior claw elongate, subparallel medially and evenly narrowing to slightly arcuate apex. Mesotarsomeres 1 to 3 broadly dilated; Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.56 to 0.66. Paramere with basal plate densely covered with parallel rugae, apical lobe elongate. Aedeagus (Fig. 160N, O) trumpet shaped, broadening distally with a large spade-shaped apical orifice in dorsal aspect; without a subapical ventral spine.

Ecology. Long series were collected from among emergent rushes at the margins of shallow, sandy lakes about 20 km southeast Ross River, Yukon Territory. These lakes were fishless, had no evident outflow and contained a community of dytiscids usually associated with mineral enriched water, supporting Zaitzev's (1953) statement that this is a species of saline waters. A few specimens were also collected from distinctly fresh water sedge marshes in the same region.

Distribution: Map 194. This Holarctic species is restricted in North America to the northwest where it has been collected in Alaska, Yukon, western Northwest Territories and northern British Columbia. The Palaearctic range extends from Kamchatka to the Ural and Caucasus Mountains.



Map 194. *Agabus costalis* Sharp. Canadian and Alaskan collection localities and United States state records.

86. *Agabus infuscatus* Aubé 1838

Fig. 160D, H – J

Agabus infuscatus Aubé 1838*b*: 330. Type locality - "Amerique Septentrionale".

Selected References. Larson 1994*a*: 159 – 161; Nilsson and Holmen 1995: 117; Larson 1997*b*: 509.

Description. Length = 6.6 to 8.7 mm; width = 3.7 to 4.9 mm; length: width = 1.69 to 1.96. Smallest and narrowest species of group, size highly varied.

Head and pronotum dark brown to piceous or, less frequently, black, with labrum, clypeus, frontal spots, and broad lateral margins of pronotum, reddish. Antenna yellow, lightly infuscate apically; palpi yellow with apical palpomere of each palpus lightly infuscate apically. Elytron yellow to pale brown, with diffuse darker brown variegations medially and posteriorly. Ventral surface mainly black. Legs largely reddish.

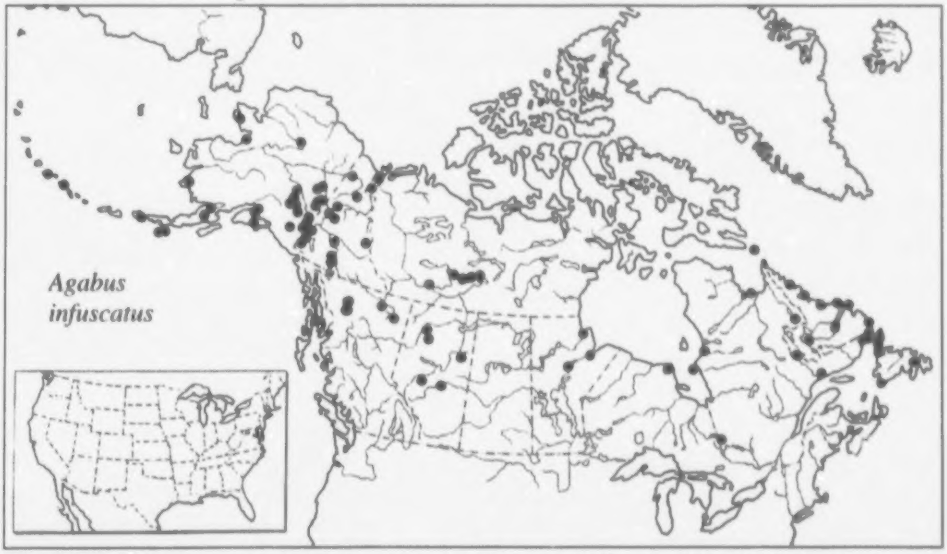
Elytron with sculpture consisting of small, rounded, more or less isodiametric meshes; meshes flat and smooth.

Clypeus with anterior bead complete. Eyes relatively large and more or less protruding beyond curvature of side of head. Pronotum with lateral bead narrow; lateral margin almost straight to broadly rounded laterally except near anterior angle where sides are more strongly curved, some specimens with side strongly rounded on anterolateral angle making apex of angle blunt or sub-truncate. Prosternum and its process in same plane in lateral aspect; process pointed apically; in cross section flat or concave near lateral bead, with a strongly raised medial carina. Metasternum with anteromedial impression well developed and extending posterad to level of hind margin of mesocoxae; width of metacoxa: width of metasternal wing = 2.03 to 3.79. Metacoxae with intralinear space bearing coarse irregular punctures and rugae which give surface a scabrous appearance; metacoxal process with inner edge of posterolateral emargination swollen forming a small tubercle. Metafemur with faint, short, oblique strioles; length: width = 3.00 to 3.50. Metatibia with several separated punctures along posteroventral margin, mesal face impunctate or sparsely micropunctate.

Male with antennomeres 5 to 8 each with anteroapical angle slightly produced, making antenna somewhat serrate. Protarsus moderately dilated, width protarsomere 1 = 0.20 to 0.30 mm, protarsal ratio = 2.01: 1.90: 1.62: 1.13: 1; protarsomeres 1 to 3 bearing large, round suckers beneath; protarsal claws (Fig. 160D) elongate, subequal, with posterior claw slightly narrower than anterior. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.77 to 0.91. Aedeagus (Fig. 160I, J) with a subapical spine.

Ecology: This species occurs in small barren, rock pools such as described by Wallis (1973) as well as in artificially formed habitats such as gravel pits, quarry pools and highway ditches. They are generally in permanent ponds, frequently ones fed by seepages or small springs. In Labrador, specimens are common along the margins of large lakes where emergent plants grow on clean sand or hard packed clay.

Distribution: Map 195. This is a Holarctic species which occurs from Siberia to Fennoscandia in the Palaearctic, and from Newfoundland to the Aleutian Islands, Alaska, in the Nearctic. The species occurs in both the boreal and arctic zones.



Map 195. *Agabus infuscatus* Aubé. Canadian and Alaskan collection localities and United States state records.

Agabus confinis-group

Figs. 161 – 165.

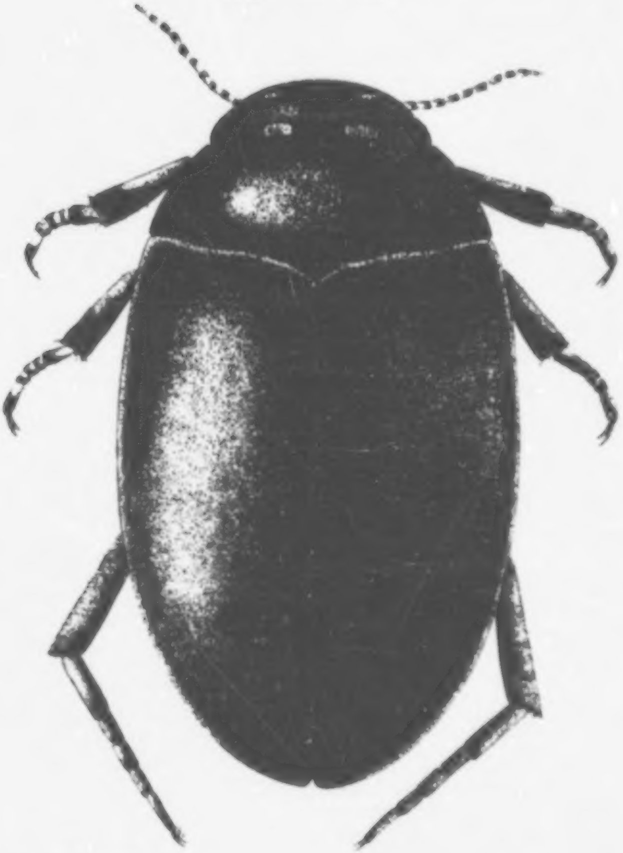


Fig. 161. *Agabus confinis* habitus.

Arctodytes Thomson 1874: 541. Type species - *Dytiscus elongatus* Gyllenhal, by monotypy.

Diagnosis. Small to moderately large species, length = 5.7 to 10.3 mm, body shape ovate to elongate-oval. Head and pronotum piceous to black, on most specimens distinctly darker than pale brown to piceous elytra although some specimens with elytra dark medially and more or less concolorous with dark disc of pronotum; epipleuron yellow to piceous. Sculpture various, elytron generally with lines fine, meshes small, isodiametric to very unequal in size and shape, some specimens with coarse, irregular meshes; meshes without secondary microreticulation but many specimens with small punctures situated medially in meshes; punctures lacking or inconspicuous in intersections of lines in North American species, evident in some Palaearctic species. Metafemur lacking evident strioles. Clypeus with anterior bead complete. Pronotum with anterior submarginal series of punctures complete or only narrowly broken medially; anterior marginal bead obsolete medially. Prosternal process various, flat in cross section to tectiform or carinate; apex bluntly pointed to acuminate; lateral bead not dilated basally. Metasternum with anteromedial impression well developed, extending posteriorly to or

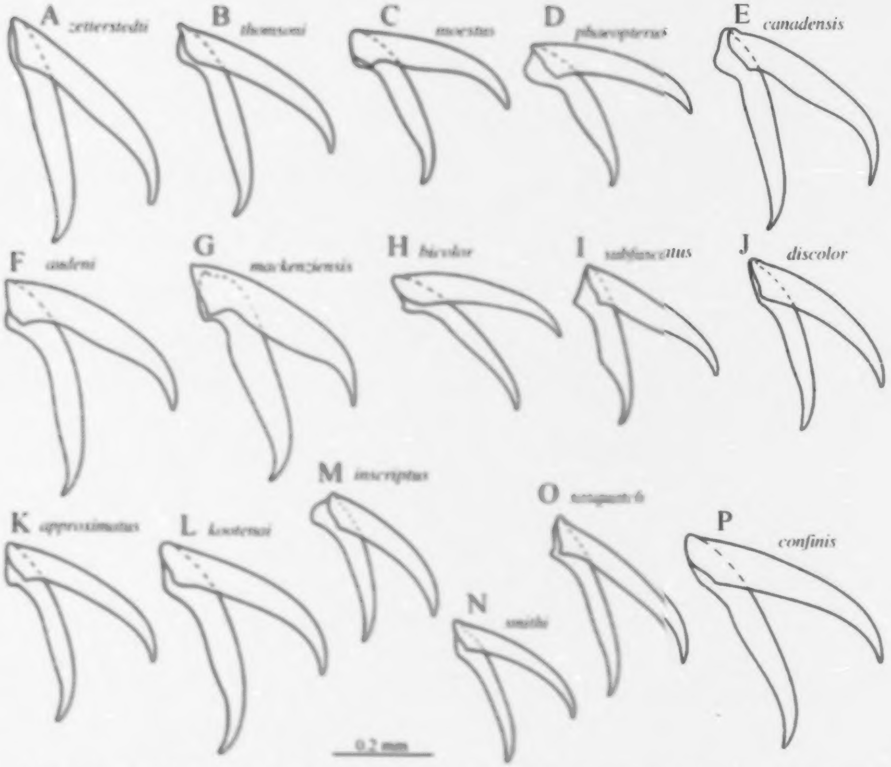

A zetterstedti
B thomsoni
C moestus
D phaeopterus
E canadensis
F audeni
G mackenziensis
H bicolor
I subfuscatus
J discolor
K approximatus
L kootenai
M inscriptus
N smithi
O sasquatch
P confinis
0.2 mm

Fig. 162. *Agabus confinis*-group, male protarsal claws, anterior. A - *A. zetterstedti*. B - *A. thomsoni*. C - *A. moestus*. D - *A. phaeopterus*. E - *A. canadensis*. F - *A. audeni*. G - *A. mackenziensis*. H - *A. bicolor*. I - *A. subfuscatus*. J - *A. discolor*. K - *A. approximatus*. L - *A. kootenai*. M - *A. inscriptus*. N - *A. smithi*. O - *A. sasquatch*. P - *A. confinis*.

almost to level of hind margin of mesocoxae. Metacoxal lines traceable to mesosternum. Metatibia with punctation various, posteroventral margin lacking punctures on many specimens, others with isolated punctures basally or with a series of separated punctures extending distally for various distances; medioventral face impunctate; longest metatibial spur shorter than metatarsomere 1. Metatarsomeres without dorsal setiferous punctures, metatarsomere 1 with or without ventral accessory punctures.

Male protarsomeres 1 to 3 narrowly to moderately dilated, protarsomeres 1 to 3 ventrally with small, eccentrically stalked, ovate or reniform scales; protarsal claws (Fig. 162) little to distinctly modified, posterior subequal in length to or slightly shorter than anterior, narrower and usually more evidently sinuate ventrally. Paramere (Fig. 163, 164) stylate, with basal sclerite oval, apex with a reflexed apical lobe; aedeagus (Fig. 165) with basal apodemes small to moderate, with an acute subapical ventral spine (or spine secondarily lost), apex in dorsal aspect twisted to right. Gonocoxae elongate, laterally flattened and triangular in shape, lightly sclerotized, variously setose apically and ventrally.

Comments. This group is broader than the *confinis*-group as defined by Larson (1991*b*), and includes the members of the *elongatus*- and *zetterstedti*-groups. The aggregate range of the group is Holarctic, and several of the species are also Holarctic. This is the dominant element in the *Agabus* fauna of arctic and alpine regions and is the largest and most taxonomically difficult group in North America. Larson (1991*b)* revised the group.

The life histories of these insects have not been studied in North America. However, the life histories of a number of Palaearctic and Holarctic species are known through studies conducted in Europe. All members of the group reviewed by Nilsson (1986) have his type 3 life history. Adults overwinter on land. Females lay eggs in early spring which undergo a diapause and do not hatch until the following spring. Larvae complete development the summer they hatch.

The habitat is generally small peaty pools, vernal ponds or the vegetation rich margins of marshes although some species occur in depositional areas of small streams and in springs. In arctic and alpine areas, specimens may occur on mineral substrates in barren pools and ponds.

87. *Agabus elongatus* Gyllenhal 1826

Fig. 163A – D

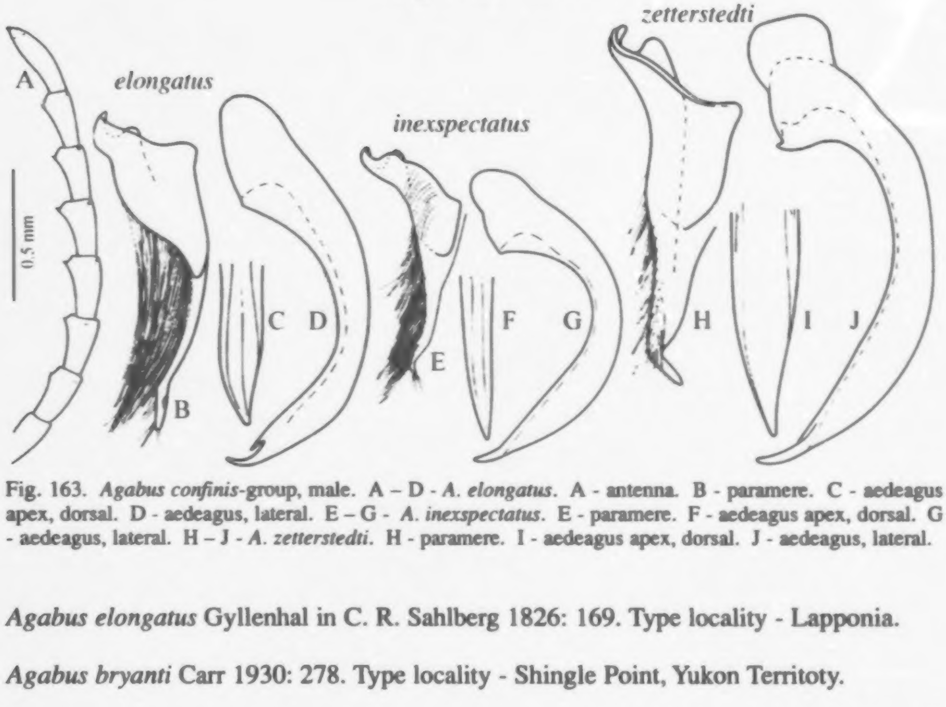


Fig. 163. *Agabus confinis*-group, male. A – D - *A. elongatus*. A - antenna. B - paramere. C - aedeagus apex, dorsal. D - aedeagus, lateral. E – G - *A. inexspectatus*. E - paramere. F - aedeagus apex, dorsal. G - aedeagus, lateral. H – J - *A. zetterstedti*. H - paramere. I - aedeagus apex, dorsal. J - aedeagus, lateral.

Agabus elongatus Gyllenhal in C. R. Sahlberg 1826: 169. Type locality - Lapponia.

Agabus bryanti Carr 1930: 278. Type locality - Shingle Point, Yukon Territoty.

Selected References. Carr 1930: 278; Larson 1991*b*: 1245; Nilsson and Holmen 1995: 110 – 111; Larson 1997*b*: 509.

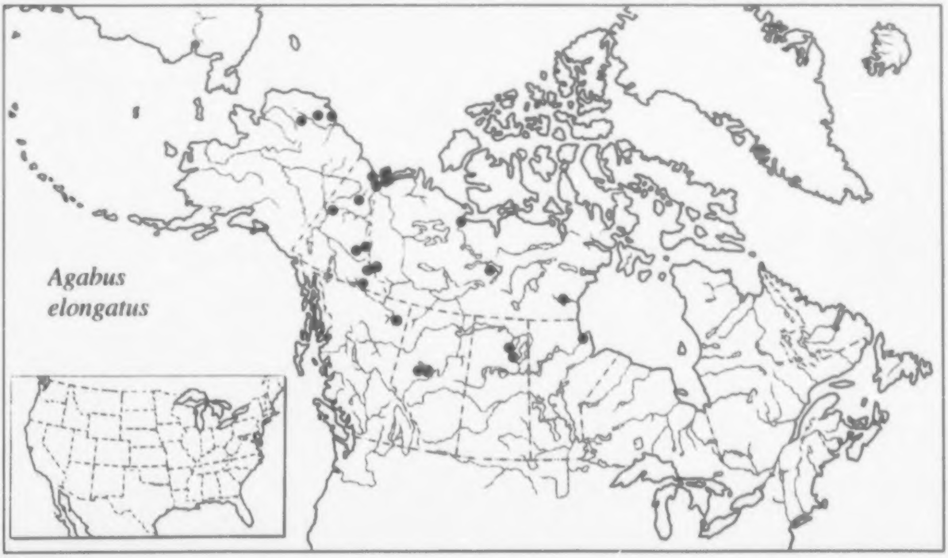
Description. Length = 5.8 to 7.4 mm; width = 2.85 to 3.56 mm; length: width = 1.89 to 2.16. Small species, body narrow and parallel sided.

Head and pronotum mainly black. Elytron brown laterally, darkened medially on disc; epipleuron piceous mesally, reddish laterally. Ventral surface mainly black. Legs rufous to pale brown with femora infuscate, at least basally.

Head with small, irregular meshes. Pronotum medially with sculpture similar to that of head, laterally meshes smaller and more regular in size and shape. Elytron with sculpture fine, consisting of small, more or less rounded, isodiametric meshes.

Head appearing very broad; antenna subserrate, antennomeres 6 to 9 with anteroapical angle produced and obliquely truncated apically, best developed on male (Fig. 163A). Pronotum broadly and evenly convex with convexity beginning immediately mesad of lateral bead; lateral bead narrow, clearly defined throughout its length. Elytron slightly ascendant to humeral angle in lateral aspect, epipleuron hidden for short distance behind shoulder. Prosternal process in same plane as midline of prosternum; blade of process flat or even slightly concave basally, slightly but evenly convex apically; surface finely and sparsely punctate, glabrous; apex sharply pointed but not acuminate. Metasternum with anteromedial impression well developed and extending posterad to level of hind margin of mesocoxae; metasternal wings moderately broad, width of metacoxa: width of metasternal wing = 2.08 to 2.54. Protibia broadly expanded apically, apex subtruncate. Tarsomere 5 of pro- and mesotarsi relatively large in both sexes. Metafemur very finely and sparsely punctate; length: width = 3.23 to 3.50. Metatibia with from one to six punctures along basal half of posteroventral margin; longer metatibial spur about two-thirds length of metatarsomere 1. Metatarsomere 1 lacking ventral accessory setae.

Male protarsus slightly dilated, protarsal ratio = 1.38 : 1.30 : 1.11 : 1.02 : 1; protarsomere 5 large, with a large, acute, ventral tooth; protarsal claws elongate, anterior claw shorter and narrower than posterior, deeply emarginate basally. Mesotarsus with tarsomere 5 elongate, Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.86 to 0.90. Paramere (Fig. 163B) with ventral and lateral faces densely setose, apical membranous style elongate, not reflexed apically; aedeagus (Fig. 163C, D) with a subapical ventral spine; shaft in lateral aspect broadened subapically, ventral margin rounded near base.



Map 196. ***Agabus elongatus*** **(Gyllenhal). Canadian and Alaskan collection localities and United States state records.**

Ecology. These beetles occur in small, cold, moss-ringed pools, typically in spruce forest, as well as in tundra ponds. The larva has been described by Nilsson (1982*a*).

Distribution. Map 196. *Agabus elongatus* is Holarctic. The Nearctic range extends from the west side of Hudson Bay to Alaska, in the low arctic and northern boreal zones.

88. *Agabus inexspectatus* Nilsson 1990

Fig. 163E – G

Agabus inexspectatus Nilsson 1990: 157 – 158. Type locality – Olekminsk, Jakutskaja, Siberia.

Selected Reference. Larson 1991*b*: 1247.

Description. Length = 6.0 mm; width = 3.2 to 3.3 mm; length: width = 1.80 to 1.85.

Head and pronotum mainly black. Elytron reddish brown; epipleuron rufous except mesal margin infuscate. Ventral surface mainly black with metacoxal processes and posteromedial portions of sterna 2 to 6 rufous. Legs rufous with femora rufopiceous.

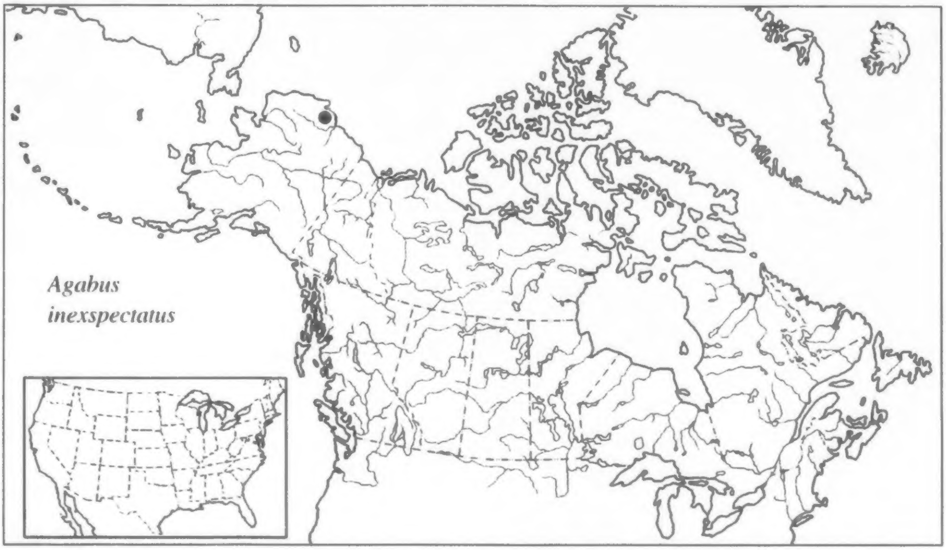
Head with small irregular meshes, some meshes bearing a small micropuncture. Pronotum with reticulation of disc consisting of small meshes of irregular size and shape. Elytron with meshes small but very irregular in size and shape over entire disc; many intersections of lines bearing a small puncture. Metacoxal plate with coarser set of lines forming somewhat longitudinal meshes, these meshes in turn rugose or with fine microreticulation. Abdominal sterna rather shiny, sternum 6 subrugose posteromedially.

Head broad, eyes relatively small; antenna not modified. Pronotum rather strongly and evenly convex; lateral bead of moderate width posteriorly, evenly narrowed towards anterolateral angle. Elytron in lateral aspect with lateral margin broadly ascendant to shoulder. Prosternal process strongly convex, tectiform with midline of convexity smoothly rounded; surface smooth, with numerous punctures sublaterally but glabrous; apex pointed. Metasternum with anteromedial impression extending posterad to level of hind margin of mesocoxae. Metasternal wing moderately narrow, width of metacoxa: width of metasternal wing = 2.78, 2.85. Hind legs slender, metafemur length: width = 3.52. Metatibia with small, separated punctures along basal three quarters of length; metatibial spurs distinctly shorter metatarsomere 1. Metatarsomere lacking ventral accessory setae.

Male protarsus relatively robust but basal tarsomeres only slightly dilated, protarsal ratio = 1.45: 1.36: 1.27: 1.09: 1; protarsomeres 1 to 3 each with a few small, oval scales beneath; protarsomere 5 not modified; protarsal claws elongated, slightly longer than protarsomere 5, narrow. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45. Paramere (Fig. 163E) with apical reflexed lobe very short; aedeagus (Fig. 163F, G) in lateral aspect strongly arcuate, broadened subapically with apex narrowly produced; without a subapical ventral spine; in dorsal aspect more or less evenly narrowed to pointed apex, apex almost symmetrical with only a slight curvature to right.

Ecology. The Alaskan specimen was collected from a small tundra pool.

Distribution. Map 197. The species is known from Siberia and northern Alaska.



Map 197. *Agabus inexspectatus* Nilsson. Canadian and Alaskan collection localities and United States state records.

89. *Agabus zetterstedti* Thomson 1856

Fig. 162A, 163H – J

Agabus zetterstedti Thomson 1856: 216. Type locality - Lapland, Sweden.

Selected References. Nilsson 1984*a*: 487 – 491; Larson and Nilsson 1985: 127; Larson 1991*b*: 1248; Nilsson and Holmen 1995: 109 – 110; Larson 1997*b*: 511.

Description. Length = 7.5 to 8.6 mm; width = 4.14 to 4.5; length: width = 1.87 to 2.04. Moderate size, shape elongate-oval, widest behind middle lateral, outline continuous or with slight discontinuity between pronotum and elytron.

Head rufopiceous to black, except frontal spots and anterior margin of clypeus, rufous; mouthparts rufous, palpi yellow, most specimens with apical palpomere of each palpus lightly infuscate apically; antenna testaceous with at least apical antennomere lightly infuscate apically. Pronotum piceous to black medially, lateral bead translucent, rufous, anterolateral angle and disc mesad to bead rufous to rufopiceous, gradually darkened onto disc. Elytron yellow to pale reddish brown basally and laterally, darker reddish brown to piceous medially and apically; epipleuron pale. Ventral surface rufopiceous to piceous, abdomen paler than thorax. Legs reddish with femora infuscate.

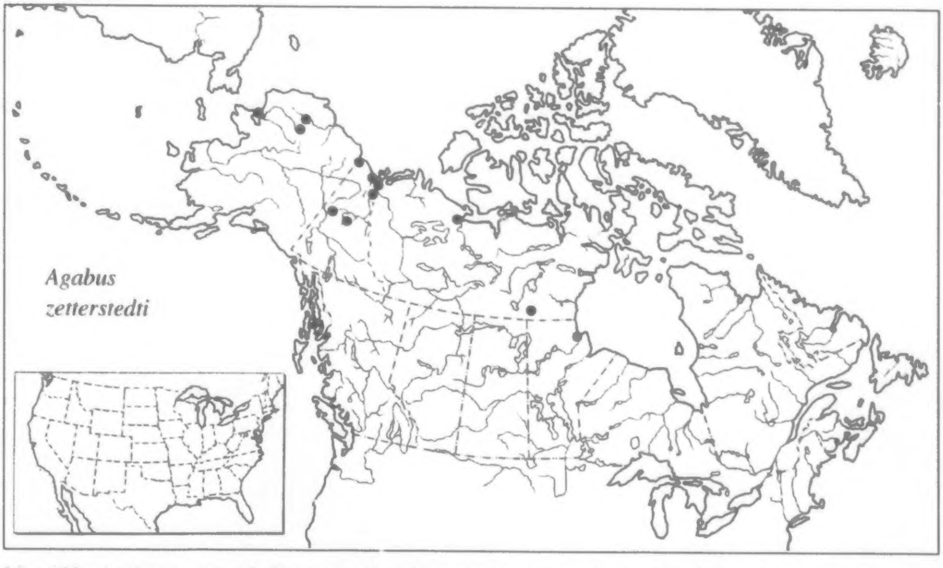
Head and pronotum with lines of sculpture deep, forming moderately large meshes of irregular size and shape, some meshes rugose but without distinct microreticulation. Elytron with sculpture coarse, lines deep and forming small to moderate meshes of very irregular sizes and somewhat angular shapes, edges of meshes more or less rounded and granular; punctures present in some meshes but not conspicuous; some meshes with a few faint lines but not evidently microreticulate. Metacoxal plate coarsely sculptured, with dense lines forming irregular, elongated meshes; meshes rugose or with microreticulation.

Pronotum with lateral bead strongly delimited, of moderate width and narrowed only on anterolateral angle; disc mesad of bead flat or very slightly and broadly convex. Prosternal process strongly but smoothly and evenly convex in cross section, surface smooth but finely punctate; apex acutely pointed; in lateral aspect process on slightly lower plane than midline of prosternum but descent gradual. Metasternum deeply incised anteromedially, impression extending posterad to level of hind margin of mesocoxae. Width of metacoxa: width of metasternal wing = 2.45 to 3.15. Metafemur with sparse but distinct punctation; with lines of sculpture very strong, on some specimens lines locally deeper to form short strioles; length: width = 3.19 to 3.35. Metatibia irregularly punctate along posteroventral margin. Metatarsomere 1 without accessory setae, longer than tibial spur.

Male protarsomeres 1 to 3 broadly dilated, protarsal ratio = 2.40: 2.15: 1.69: 1.13: 1; with moderate sized, apically truncate, oval scales beneath; protarsal claws (Fig. 162A) elongate, anterior claw very slightly longer, narrower and more sinuate ventrally than posterior claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.57 to 0.62. Aedeagus (Fig. 163I, J) with a very small, obscure subapical ventral spine; in ventral aspect aedeagus broad, with tip slightly curved to right.

Ecology. This species occurs in small, temporary pools with aquatic mosses (Nilsson 1984*a*). Nilsson (1984*a*) described the larva.

Distribution. Map 198. The range is Holarctic in arctic and subarctic regions. The species occurs across northern Eurasia to Fennoscandia, and south in Sweden to 65° N. In North America, it occurs in the low arctic from Churchill, Manitoba, to Alaska.



Map 198. *Agabus zetterstedti* Thomson. Canadian and Alaskan collection localities and United States state records.

90. *Agabus thomsoni* (J. Sahlberg, 1871)

Figs. 162B; 164A – C

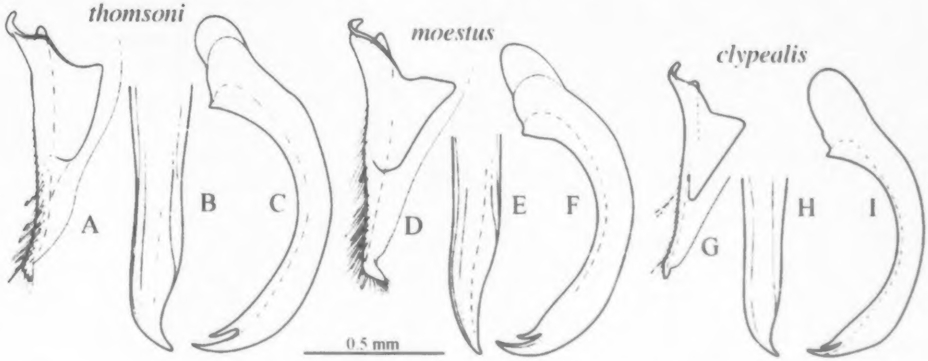


Fig. 164. *Agabus confinis*-group, male. A – C - *A. thomsoni*. A - paramere. B - aedeagus apex, dorsal. C - aedeagus, lateral. D – F - *A. moestus*. D - paramere. E - aedeagus apex, dorsal. F - aedeagus, lateral. G – I - *A. clypealis*. G - paramere. H - aedeagus apex, dorsal. I - aedeagus, lateral.

Gaurodytes thomsoni J. Sahlberg 1871: 407. Type locality - Kilpisjarvi, Finnish Lapland.

Selected References. Nilsson 1984; Larson 1991*b*: 1255 – 1257; Hilsenhoff 1993*c*: 190; Nilsson and Holmen 1995: 113 – 114; Larson 1997*b*: 510.

Description. Length = 6.4 to 8.4 mm, width = 3.3 to 4.4, length: width = 1.80 to 2.02. Medium sized species for group, shape somewhat elongate, body outline more or less continuous.

Head mainly black except a pair of frontal spots on frons between eyes, and anterior margin of clypeus, rufous. Palpi yellow, each with terminal palpomere infuscate and piceous on apical quarter to half; antenna yellow to reddish, antennomeres 4 or 5 to 11 variously infuscate apically. Pronotum with disc black, lateral bead reddish to piceous, some specimens with anterolateral angle reddish and disc narrowly piceous mesad to lateral bead. Elytron reddish brown to piceous dorsally, some specimens with a vary faint aeneous sheen; epipleuron pale. Ventral surface of body mainly black with propleuron reddish (especially at anterior angle), and metacoxal processes and posterior margin of sterna 3 to 6, reddish to piceous. Legs reddish, pro- and mesofemora and hind legs darker.

Elytron with sculpture sexually dimorphic, but in both sexes meshes irregular in size and shape and angular in outline; male with lines fine, meshes flat, diameter of meshes various but generally less than diameter of serial punctures; female with lines deeper and coarser, meshes smaller and more granular, especially on basomedial area. Metacoxal plate with small irregular or longitudinal meshes, meshes with variously effaced microreticulation.

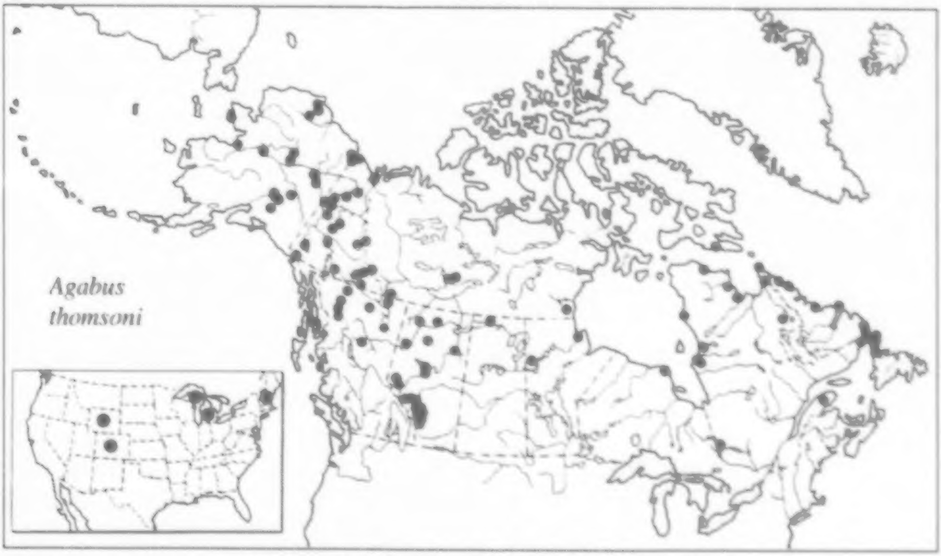
Pronotum with disc relatively flat laterally, at most only slightly convex adjacent to bead and not impinging on or obscuring bead when examined in dorsal aspect; posterolateral angle obtuse, narrowly rounded apically. Elytron with lateral margin more or less straight in lateral aspect. Prosternal process more or less in same plane as prosternum medially, convex in cross section but convexity low and more or less evenly rounded, smooth and sparsely and finely punctate; apex pointed but not strongly acuminate, received into well defined impression of metasternum which extends posteriorly to level of hind margin of mesocoxal cavities. Metasternal wings broad, width of metacoxa: width of metasternal wing = 1.68 to 2.40. Metafemur finely and sparsely punctate. Metatibia with ventral face impunctate medially, posteroventral margin with a few punctures restricted to basal third on most specimens. Metatarsomere 1 slightly longer than longest metatibial spur; lacking accessory setae on ventral surface.

Male protarsus evidently dilated, protarsal ratio = 1.73: 1.59: 1.34: 1.13: 1; protarsal claws (Fig. 162B) relatively little modified, subequal in length and approximately equal to length of protarsomere 5 (ratio length anterior claw/ length protarsomere 5 = 0.88 to 1.11). Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.51 to 0.57. Aedeagus (Fig. 164B, C) with a subapical spine; in lateral aspect shaft noticeably broadened near base of spine.

Comments. Within the North American fauna this species is rather easily recognized on the basis of its coarse sculpture, broad metatsternal wing and subapically broadened aedeagus. However, in the Palaearctic region there is a complex of similar species which have only recently become understood through morphometric (Nilsson 1987c) and allozyme analysis (Nilsson *et al*. 1988).

Ecology. These beetles occur in small pools which generally have firm, often mineral, substrates. They have been collected from barren pools as well as pools with emergent vegetation and moss along the edges.

Distribution. Map 199. This species is Holarctic. In North America it has a wide distribution in the low arctic (north to Baffin Island), boreal region and along the Rocky Mountains to Colorado.



Map 199. *Agabus thomsoni* (Sahlberg). Canadian and Alaskan collection localities and United States state records.

91. *Agabus moestus* (Curtis 1835)

Figs. 162C; 164D – F

Colymbetes moestus Curtis 1835: lx. Type locality - Cape Ross, NWT.

Selected References. Larson 1991*b*: 1257 – 1259; Nilsson and Holmen 1995: 111; Larson 1997*b*: 509.

Description. Length = 5.8 to 7.6 mm; width = 3.0 to 4.0; length: width = 1.83 to 2.05. Moderately small species, shape rather elongate, many specimens with distinct discontinuity in outline between pronotum and elytra.

Head black except frontal spots yellow, and clypeus with anterior margin narrowly reddish to piceous; palpi yellow with distal palpomere piceous or black except for extreme apex and at base; antenna yellow basally, infuscate distally, beginning on most specimens on antennomere 4. Pronotum black with lateral bead at most piceous. Elytron brown to piceous, females generally darker than males; humeral angle and lateral margin paler brown; epipleuron yellow laterally, piceous mesad, at least along internal margin. Ventral surface mainly black. Front and middle legs brown with femora darker medially; hind legs dark brown to piceous.

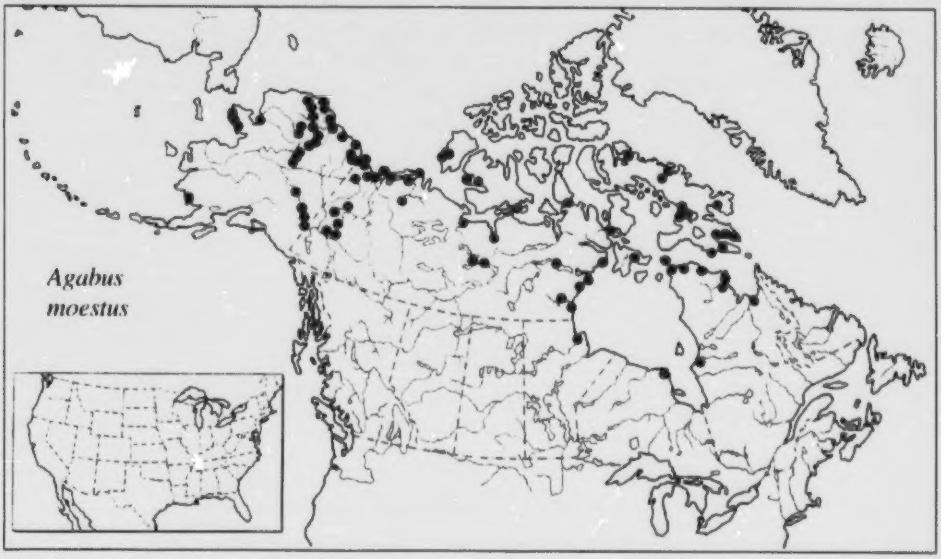
Pronotum with meshes of sculpture irregular in size and shape, lines deepest laterally where sculpture is coarser and granular. Elytral sculpture various; males and some females with meshes small and generally rounded but of varied size and shape; apically and laterally meshes more regular but shape and size slightly varying; some females with lines deep producing densely granular meshes, meshes largest basomedially and smaller apically. Metacoxal plate with a network of lines forming generally elongate meshes of varied sizes; meshes rugose to microreticulate.

Clypeus with anterior bead complete. Pronotum with disc immediately mesad to bead convex with convexity strongest on anterolateral angle but adjacent to posterolateral angle disc more or less flat; lateral bead narrow, in dorsal aspect bead narrowed or hidden near front angle by laterally swollen disc; hind angle obtuse, broader than in related species. Elytron in lateral aspect with lateral margin evidently ascendant to shoulder, epipleuron hidden behind lateral margin for only a short distance behind shoulder. Prosternal process in slightly lower plane than midline of prosternum when viewed in lateral aspect; process smoothly and strongly convex in cross section, finely and sparsely punctate; apex pointed, received into well developed metasternal impression which extends posterad to level of hind margin of mesocoxae. Width of metacoxa: width of metasternal wing = 2.07 to 3.00. Metafemur length: width = 2.97 to 3.62; ventral surface finely and sparsely punctate. Metatibia with punctation of posteroventral margin various, most specimens with a few coarse, separated punctures on basal half to two-thirds; medioventral surface impunctate. Metatibial spurs short, length longest spur: length metatarsomere 1 = 0.75 to 0.8; metatarsomere 1 lacking accessory setae on ventral surface.

Male protarsomeres 1 to 3 relatively broadly dilated, protarsal ratio = 2.05: 1.80: 1.46: 1.16: 1; protarsal claws (Fig. 162C) little modified, slightly shorter than protarsomere 5; subequal in length, both slightly sinuate ventrally but this most evident on slightly narrower posterior claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.52 to 0.60. Aedeagus (Fig. 164E, F) with a subapical ventral spine; in lateral aspect shaft distinctly broadened basad of spine.

Ecology. This species occurs along the edges of lakes and permanent ponds within the arctic zone. They have been found amongst emergent vegetation as well as over rocky substrates. Larson and Nilsson (1985) stated that the species occurs only north of the tree line, but specimens have subsequently been collected in the central Yukon Territory, south to Mayo. At Mayo, specimens were collected from among waterlogged willow leaves in small, cold, spring-fed pools at the edge of a black spruce - sphagnum forest.

Distribution. Map 200. This is the most northerly species of Agabus in the fauna and has been collected frequently along the arctic coast and lower arctic islands (Sherman 1922). It occurs throughout the arctic portion of the Palaearctic. In the Nearctic it occurs across the arctic mainland and onto the lower tier of arctic islands. It is surprising that the species does not occur on Greenland.



Map 200. *Agabus moestus* (Curtis). Canadian and Alaskan collection localities and United States state records.

92. *Agabus clypealis* (Thomson 1867)
Fig. 164G – I

Gaurodytes clypealis Thomson 1867: 107. Type locality - Klinta, Scania.

Selected References. Larson 1991*b*: 1259 – 1260; Nilsson and Holmen 1995: 114 – 115; Larson 1997*b*: 508.

Description. Length = 5.8 to 6.8 mm; width = 3.0 to 3.5 mm; length: width = 1.83 to 1.98. A small species, body moderately narrow, curvature of lateral margin more or less continuous.

Head mainly black except frontal spots, anterior margin of clypeus and frons above antennal bases, red; mouthparts yellow to reddish; palpi yellow, each palpus with apical third to half of terminal palpomere infuscate; antenna yellow, distal antennomeres infuscate apically. Pronotum with disc black; lateral bead translucent, dark rufous to piceous; anterolateral angle and disc narrowly mesad to lateral bead, reddish. Elytron pale brown laterally and basally, darker reddish brown medially and apically; epipleuron yellow. Ventral surface mainly black except propleuron, prosternal process, metacoxal processes and posterior margins of sterna 3 to 6, reddish. Each leg with femora dark brown to piceous, tibia and tarsus pale brown to reddish.

Head with small irregular meshes, longitudinally stretched along posterior margin; a few small punctures present, most evident posteriorly at intersections of some lines. Pronotum with meshes small and irregular medially on disc, lines deeper sublaterally and meshes more granular and rounded; adjacent to lateral bead meshes small and rounded on most specimens. Elytron with lines fine, meshes small and rounded but of somewhat irregular size and shape, this irregularity clearly evident at 100x, meshes slightly granular; laterally and apically sculpture more regular; micropunctures present on some of the enlarged meshes but punctation not conspicuous.

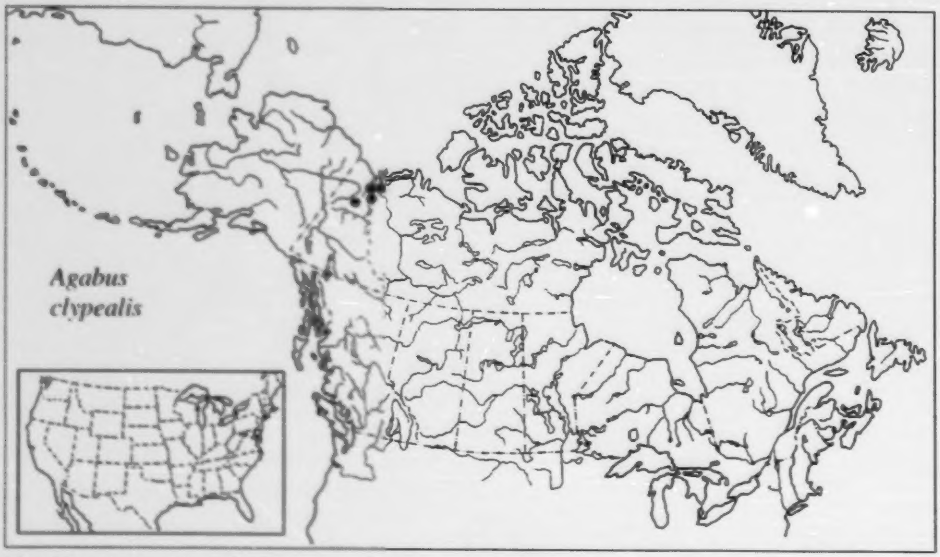
Palpi, especially labial palpus, shorter and stouter than in related species. Pronotum with marginal bead of moderate width, of more or less uniform width throughout length or narrowing slightly on anterolateral angle; bead visible onto front angle in dorsal aspect, disc mesad to bead slightly convex, not conspicuously inflated anterad. Elytron with lateral margin faintly ascending to humeral angle in lateral aspect, or almost straight. Prosternal process rather narrow, convex in cross section but convexity more or less even and most specimens without an evident medial angulation; apex sharply pointed; surface finely punctate but glabrous. Metasternal impression attaining level of hind margin of mesocoxal cavities; width of metacoxa: width of metasternal wing = 2.37 to 2.91. Metafemur length: width = 3.23 to 3.48. Metatibia with punctation of posterior margin various, some specimens with punctures absent, others with up to 8 punctures extending along basal three-quarters of length but most specimens with punctures restricted to basal third; metatibial spurs elongate, longest spur = 0.72 to 0.89 length of metatarsomere 1. Metatarsomere 1 lacking ventral accessory setae.

Protarsus narrowly dilated, protarsal ratio = 1.58: 1.50: 1.30: 1.12: 1.00; protarsal claws little modified, subequal in length, and 0.84 to 0.89 length of protarsomere 5. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.58. Paramere (Fig. 164G) with reflexed apical lobe very short; aedeagus (Fig. 164H, I) with an acute subapical spine, in lateral aspect shaft strongly widened just proximad of base of subapical spine, ventral margin flat basally.

Comments. This species is a member of a complex of small, poorly collected and poorly understood northern species. Nilsson and Holmen (1995), on the basis of the known distribution of *A. clypealis* in the Palaearctic, felt the Nearctic occurrence of the species was "problematical". This complex needs revision.

Ecology. Specimens were collected from a small moss and grass choked tundra stream at Mile 264, Demster Highway, Yukon (CARR).

Distribution. Map 201. The range extends from northern Europe to the western Northwest Territories.



Map 201. *Agabus clypealis* (Thomson). Canadian and Alaskan collection localities and United States state records.

93. *Agabus phaeopterus* (Kirby 1837)

Figs. 162D; 165A, B

Colymbetes phaeopterus Kirby 1837: 70. Type locality - North America.

Selected References. Larson 1991*b*: 1260 – 1262; Hilsenhoff 1993*c*: 187 – 188; Larson 1997*b*: 510.

Description. Length = 6.1 to 7.6 mm; width = 3.2 to 4.1 mm; length: width = 1.77 to 2.00. Small to moderate size.

Head black except frontal spots, anterior margin of clypeus, labrum, and frons above antennal base, obscurely to distinctly rufous; antenna yellow, at least apical antennomere infuscate apically; palpi yellow with apical palpomere infuscate. Pronotum black with lateral bead and narrow margins of disc mesad to lateral bead, dark rufous to piceous. Elytron with epipleuron and base yellow to pale brown, disc darker brown to piceous medially and apically on most specimens. Ventral surface mainly black, except propleuron (at least anteriorly), metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs rufous with femora slightly darkened medially.

Head and pronotum with small meshes of irregular size and shape, meshes smaller and more rounded laterally on pronotum. Elytron with sculpture consisting of small, rounded, more or less isodiametric meshes (meshes may be slightly irregular in size basomedially on some specimens); evident but small, evenly spaced punctures present, each puncture situated medially in a slightly enlarged mesh.

Pronotum with lateral bead narrow, widest in basal half, narrowed towards front angle; disc mesad to lateral bead inflated, especially along anterior half of pronotal margin so that lateral bead not visible on anterolateral angle in dorsal aspect on many specimens. Prosternal process convex medially in cross section, broadly and evenly

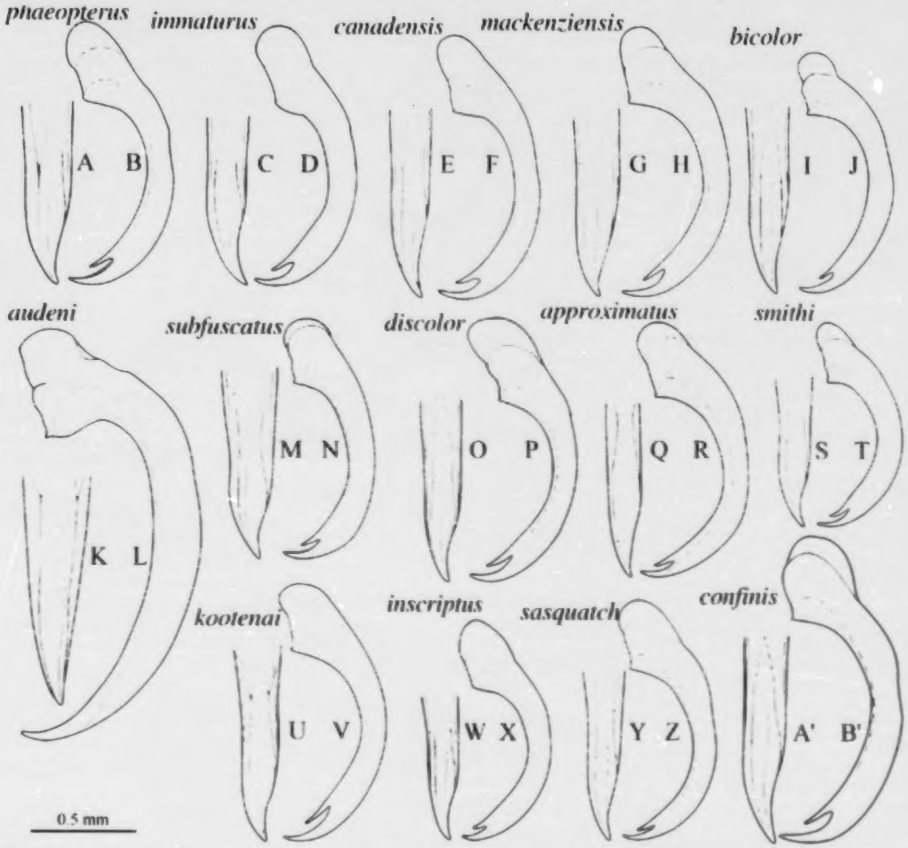

phaeopterus
immaturus
canadensis
mackenziensis
bicolor
A B
C D
E F
G H
I J
audeni
subfuscatus
discolor
approximatus
smithi
K L
M N
O P
Q R
S T
kootenai
inscriptus
sasquatch
confinis
U V
W X
Y Z
A' B'
0.5 mm

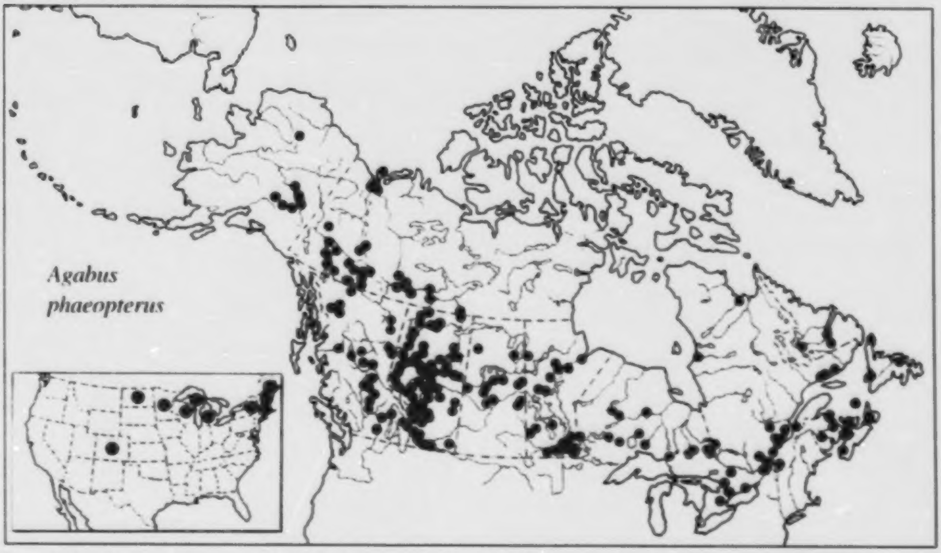
Fig. 165. *Agabus confinis*-group, aedeagus, dorsal and lateral. A, B - *A. phaeopterus*. C, D - *A. immaturus*. E, F - *A. canadensis*. G, H - *A. mackenziensis*. I, J - *A. bicolor*. K, L - *A. audeni*. M, N - *A. subfuscatus*. O, P - *A. discolor*. Q, R - *A. approximatus*. S, T - *A. smithi*. U, V - *A. kootenai*. W, X - *A. inscriptus*. Y, Z - *A. sasquatch*. A^1, B^1 - *A. confinis*.

rounded, at most faintly angulate; glabrous with small separated punctures. Metasternum with anteromedial impression well developed and extended to level of hind margin of mesocoxal cavities. Width of metacoxa: width of metasternal wing = 2.29 to 3.14; metacoxal plate with fine lines forming small meshes which are longitudinally stretched on at least lateral half of plate, meshes faintly rugose to microreticulate. Metafemur finely and sparsely punctate; length: width = 3.03 to 3.46. Metatibia with posteroventral margin impunctate or with a few punctures scattered along basal half of margin. Metatarsomere 1 slightly longer than longest metatibial spur; most specimens with one to several accessory setae on ventral face.

Male protarsomeres narrowly dilated, protarsal ratio = 1.54: 1.46: 1.26: 1.10: 1; protarsomeres 1 to 3 with small oval scales on ventral surface; protarsal claws (Fig. 162D) subequal, slender and relatively short, each slightly sinuate ventrally, best developed on posterior claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.51 to 0.62. Aedeagus (Fig. 165A, B) with a subapical spine; shaft not widened subapically near base of spine.

Ecology. Members of this species occur among emergent vegetation at the margins of small, often vernal, pools. Although the beetles occur in forested or parkland regions, they are usually in pools exposed to sunlight or shaded by willows or alders.

Distribution. Map 202. The range extends from Newfoundland to central Alaska, mainly within the boreal zone.



Map 202. *Agabus phaeopterus* (Kirby). Canadian and Alaskan collection localities and United States state records.

94. *Agabus immaturus* Larson 1991

Fig. 165C, D

Agabus immaturus Larson 1991: 1263. Type locality - Tabusintac, New Brunswick. Type in CNC.

Selected Reference. Hilsenhoff 1993*c*: 186.

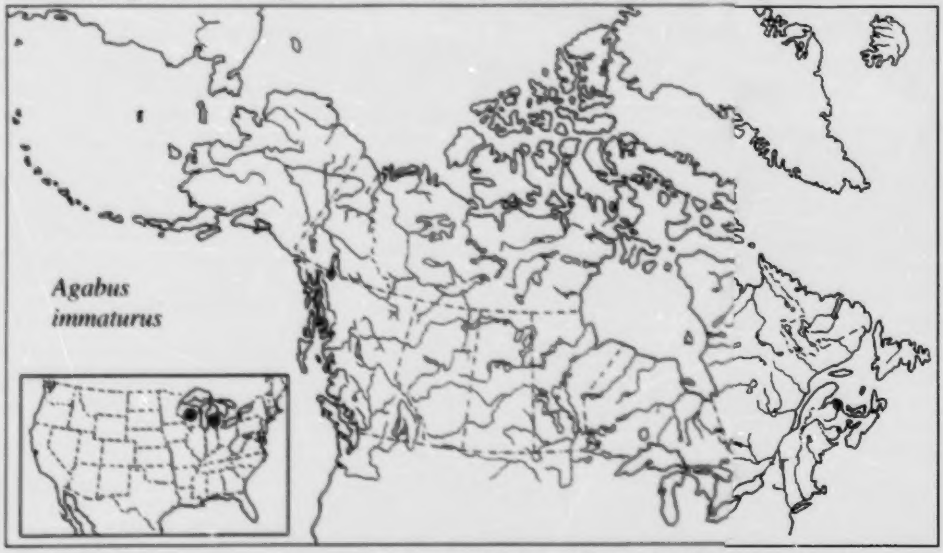
Description. Length = 6.8 to 7.6 mm; width = 3.7 to 4.1 mm; length: width = 1.78 to 1.92 mm. Very similar to *A. phaeopterus* but on average slightly larger and broader.

Head dark reddish to piceous, not black (at least when examined in bright light), frontal spots, most of clypeus and frons above base of antenna, reddish; mouthparts yellow, palpi entirely pale or with apical palpomere lightly infuscate apically on some specimens; antenna pale, with apical antennomere (some specimens also with a few subapical antennomeres) lightly infuscate apically; ventral surface of head mainly reddish. Pronotum with disc dark brown to piceous, lateral margin reddish and gradually darkened onto disc; proepipleuron red. Elytron yellow to reddish brown, palest basally and laterally; epipleuron yellow. Ventral surface with prosternum medially, metasternum medially and basomedial portions of abdominal sterna piceous to black, remainder variously red to rufescent. Legs red to reddish brown, femora pale but meso- and metatibia slightly darker on some specimens.

Head and pronotum with meshes of sculpture very fine, medially meshes only slightly coarser than those of elytron but of varied size and shape, laterally on pronotum meshes rounded, more or less isodiametric and similar to those of elytron; inconspicuous punctures present both in larger meshes and at some intersections of lines. Elytron with meshes small, rounded and more or less isodiametric; evenly spaced micropunctation present, each micropuncture situated in an enlarged mesh. Metacoxal plate more finely sculptured than in *A. phaeopterus*, with dense longitudinal lines and finer secondary lines; inconspicuous, sparse punctures present. Sternum 6 with rugose sculpture relatively fine.

Palpi slender. Pronotum with lateral bead narrow, of more or less even width on basal two thirds, narrowed on front angle, in dorsal aspect more or less hidden on front angle by inflated side of pronotum; disc mesad to bead smoothly convex, most strongly so near anterolateral angle. Prosternum with process stepped down onto slightly lower plane than midline of prosternum; process narrower than that of *A. phaeopterus*, medial convexity strong, more broadly and evenly rounded than medial convexity of prosternum; surface smooth, micropunctate; apex evenly narrowed to a sharp point. Metasternum with anteromedial impression reaching level of hind margin of mesocoxal cavities; metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.20 to 3.95. Metafemur length: width = 2.93 to 3.13. Metatibia with punctation of posteroventral margin reduced, most specimens with 4 or fewer small punctures irregularly distributed along basal half; longer metatibial spur slightly shorter than metatarsomere 1. Metatarsomere 1 with one or more small accessory punctures on ventral surface of most specimens.

Male protarsus narrow, protarsal ratio = 1.57: 1.44: 1.22: 1.08: 1.00; protarsomeres 1 to 3 with small, oval scales beneath; protarsal claws subequal in length to protarsomere 5, anterior claw slightly longer than posterior; anterior claw little modified, posterior claw distinctly sinuate along ventral margin. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.49 to 0.55. Aedeagus (Fig. 165C, D) with a subapical ventral spine, shaft very slightly broadened subapically.



Map 203. *Agabus immaturus* Larson. Canadian and Alaskan collection localities and United States state records.

Ecology. Hilsenhoff (1993*c*) collected specimens from sedge marshes.

Distribution. Map 203. This species is known from two rather widely separated regions, northern New Brunswick and the southern Great Lakes region, Michigan and Wisconsin.

95. *Agabus canadensis* Fall 1922

Figs. 162E; 165E, F

Agabus canadensis Fall 1922: 27. Type locality - Aweme, Manitoba.

Selected Reference. Larson 1991*b*: 1264 – 1265; Hilsenhoff 1993*c*: 183; Larson 1997*b*: 508.

Description. Length = 6.7 to 7.9 mm; width = 3.6 to 4.4 mm; length: width = 1.71 to 1.89. Shape broadly oval.

Head dark rufous to piceous (seldom if ever truly black) except frontal spots, anterior portion of clypeus and frons above base of antenna, red; mouthparts yellow, palpi yellow with apical palpomere of each palpus lightly infuscate apically; antenna yellow, outer antennomeres infuscate apically; ventral surface of head dark rufous to piceous. Pronotum dark rufous to piceous medially, lateral margins broadly red with width of red margin about equal to basal width of anterolateral pronotal angle. Elytron yellow to reddish brown, diffusely darker medially and apically; epipleuron yellow. Ventral surface mainly piceous with proepipleuron yellow and apex of metacoxal processes and apical margin of sterna 3 to 6 reddish. Legs more or less uniformly yellow brown.

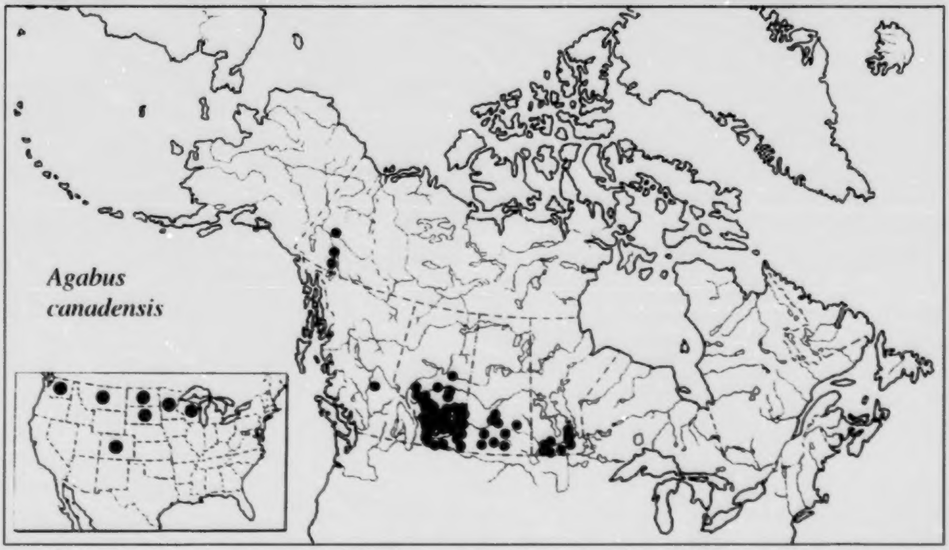
Sculpture of head consisting of deep lines forming very irregular, moderate sized meshes; punctures present on some lines and in meshes but inconspicuous. Pronotum medially with lines shallower than on head, meshes very irregular in size and shape, laterally meshes somewhat smaller but still irregular; micropunctation inconspicuous. Elytron with meshes small, rounded and approximately isodiametric although basomedially some slight irregularity present due to fusion of adjacent meshes so that sculpture not as regular as in *A. phaeopterus*; micropunctation evident, each puncture situated medially in an enlarged mesh.

Pronotum with lateral bead broadest on basal third, narrowing towards front angle; disc convex mesad to bead, most strongly so anteriorly where bead is hidden from view in dorsal aspect. Prosternal process smoothly convex; glabrous but sparsely and finely punctate; apex acute. Metasternum with anteromedial impression well developed and attaining level of hind margin of mesocoxal cavities; width of metacoxa: width of metasternal wing = 2.50 to 3.30. Metafemur length: width = 3.06 to 3.37. Metatibia with punctation of posteroventral margin various, most specimens with separated punctures on basal half but on some specimens punctures extend along entire margin forming a more or less complete row. Metatarsomere 1 of most specimens with a small group of ventral accessory setae.

Male protarsus narrowly dilated, protarsal ratio = 1.53: 1.45: 1.22: 1.06: 1; protarsomeres 1 to 3 bearing small, oval scales on ventral surface; protarsal claws (Fig. 162E) subequal in length, anterior claw slightly sinuate ventrally with apex strongly arcuate and acute, posterior claw similar in shape but narrower and with ventral sinuation more pronounced. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.49 to 0.55. Aedeagus (Fig. 165E, F) with a subapical ventral spine; shaft not distinctly broadened apically; paramere with apex normal.

Ecology. This species characteristically occurs in temporary grassland and parkland ponds. Its distribution is centred on the northern prairies and western and northern records are from locally xeric areas with expanded grassland habitat.

Distribution. Map 204. The range extends from Manitoba and extreme western Wisconsin to central British Columbia and from Colorado to the southern Yukon Territories.



Map 204. *Agabus canadensis* Fall. Canadian and Alaskan collection localities and United States state records.

96. *Agabus audeni* Wallis 1933

Figs. 162F; 165K, L

Agabus audeni Wallis 1933*b:* 270. Type locality - Okanagan, B.C.

Selected References. Carr and Leech 1966: 544; Larson 1991*b*: 1266 – 1267; Larson 1997*b*: 507.

Description. Length = 8.1 to 10.2 mm; width = 4.4 to 5.5 mm; length: width = 1.78 to 1.95. A large species, body rather broadly oval, lateral margins of pronotum and elytra forming a more or less even curvature in dorsal aspect.

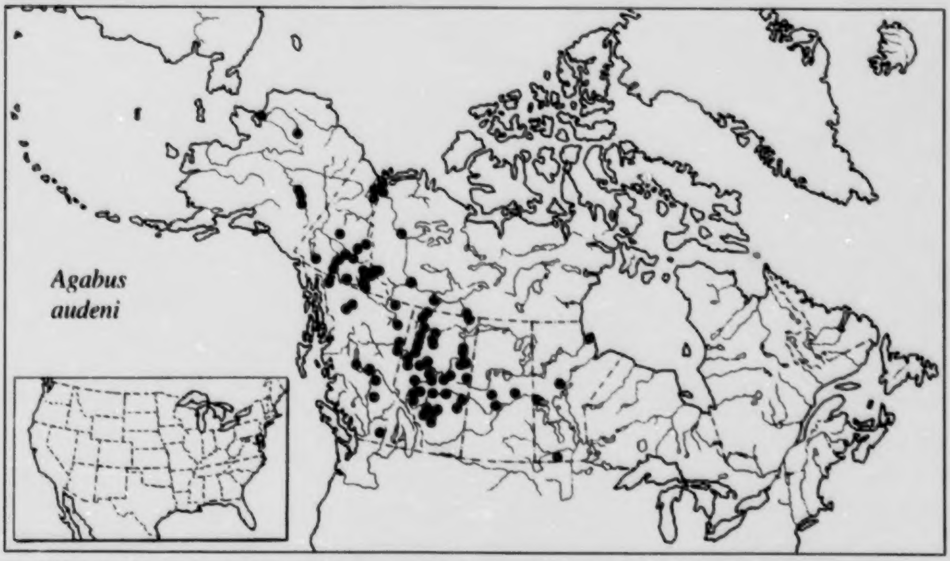
Head black except frontal spots, anterior margin of clypeus, and frons above base of antenna, dark rufous; labrum rufous; antenna testaceous except distal antennomeres lightly infuscate on some specimens; palpi testaceous. Pronotum with disc black, lateral margins broadly rufous. Elytron brown, darkest medially and apically, lateral and basal margins paler; epipleuron pale brown to rufous, slightly infuscate along inner margin on some specimens. Ventral surface mainly piceous to black. Legs rufous except femora and metatibia darker.

Head and disc of pronotum with sculpture consisting of small, rounded meshes of irregular size and shape, meshes more or less granulate at least sublaterally on pronotum. Elytron with sculpture fine, consisting of small, rounded more or less isodiametric meshes; punctation fine, each puncture occurring on a slightly enlarged mesh. Metacoxal plate irregularly microreticulate, with deeper lines forming an irregular network of longitudinally stretched meshes.

Pronotum with lateral bead narrow, widest in basal half and gradually narrowed toward anterior angle; disc strongly inflated mesad to lateral bead, especially along anterior half so that lateral bead is not visible on anterolateral angle in dorsal aspect. Prosternal process strongly but evenly convex in cross section, glabrous but micropunctate. Metasternum with anteromedial impression well developed and extended posterad to level of hind margin of mesocoxal cavities; metasternal wing relatively narrow, width of metacoxa: width of metasternal wing = 2.77 to 3.62. Metafemur length: width = 2.90 to 3.27. Metatibia with posteroventral margin bearing a series of irregularly spaced punctures along basal two-thirds to three-quarters of length. Metatarsomere 1 distinctly longer than longest metatibial spur; with a group of accessory setae on medioventral surface.

Male protarsomeres moderately dilated, protarsal ratio = 1.70: 1.50: 1.23: 1.06: 1; protarsomeres 1 to 3 ventrally with small, oval scales; protarsal claws (Fig. 162F) similar in shape, shallowly sinuate ventrally, anterior claw subequal to or slight shorter than protarsomere 5, slightly longer and broader than posterior claw. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.54 to 0.60. Aedeagus (Fig. 165K, L) large, slender, without a subapical ventral spine; apex very slightly bent to right in dorsal aspect.

Ecology. This species occurs in small, shallow, lentic habitats where there is dense emergent vegetation, usually *Carex*, that shades the water. Many such habitats are temporary, drying out in mid summer. The species is principally boreal but does occur along the southern limits of the low arctic.



Map 205. *Agabus audeni* Wallis. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 205. The known range extends from Manitoba to British Columbia and Alaska.

97. *Agabus mackenziensis* Larson 1991

Fig. 162G, 165G, H

Agabus mackenziensis Larson 1991: 1267–1269. Type locality - Fort Smith, Northwest Territories. Type in CNC.

Selected Reference. Larson 1997*b*: 509.

Description. Length = 7.4 to 8.1 mm; width = 4.0 to 4.5 mm; length: width = 1.77 to 1.90. Moderately large, broadly oval, body outline continuous.

Head black except frontal spots and anterior margin of clypeus rufous; mouthparts yellow except apical palpomere of each palpus lightly infuscate apically on most specimens; antenna yellow, antennomeres 5 or 6 to 11 lightly infuscate apically on most specimens. Pronotum black medially, with a faint metallic sheen on some specimens; lateral bead rufous and translucent, disc mesad to bead yellow to reddish, width of pale area about two to three times maximum width of lateral bead. Scutellum piceous. Elytron yellow to pale brown basally and laterally, disc darker brown medially and apically; epipleuron yellow. Body ventrally mainly piceous to black except proepipleuron yellow to brown, and metacoxal processes and apical margins of sterna 3 to 6 yellow to piceous. Legs pale brown with femora somewhat darkened.

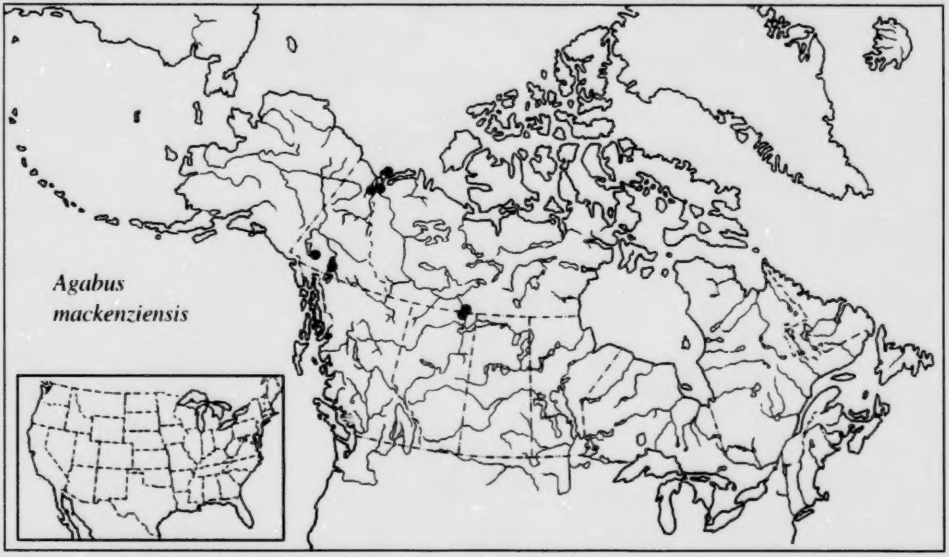
Sculpture of head consisting of well impressed lines forming meshes of very irregular size and shape, meshes slightly rounded on edges and very slightly convex (especially smaller meshes); orientation of meshes irregular or slightly longitudinal mediolaterally on frons, strongly longitudinal along hind margin of head. Pronotum with lines fine medially and forming open, irregular meshes, small punctures present at many intersections of lines; orientation of meshes irregular to slightly longitudinal; laterally lines deeper, meshes smaller and more convex. Male elytron with lines well impressed, meshes very irregular in size and shape over entire surface, largest basomedially, smaller and elytral surface more granulate apically; microreticulation lacking on meshes. Female elytron with pattern of sculpture similar but lines deeper, meshes irregular in size but with edges somewhat rounded and appearing more granular; surface of meshes slightly rugose heightening roughened appearance.

Pronotum with lateral bead of moderate width, broadest basally and narrowed anteriorly and disappearing on anterolateral angle, in dorsal aspect visible along basal 3/4 of lateral margin; disc mesad to lateral bead inflated, most strongly so anteriorly where it impinges upon lateral bead. Pronotum at base as broad as or slightly narrower than elytra across base; posterolateral angle obtuse and narrowly rounded, in dorsal aspect lateral margin of pronotum and elytra slightly discontinuous in outline. Elytron in lateral aspect with margin more or less straight, at most slightly ascendant towards humeral angle; epipleuron impressed basally and hidden in lateral aspect for a short distance behind shoulder. Prosternum strongly convex or tectiform medially, this convexity continuous onto prosternal process but medial convexity narrowly rounded and non-carinate; process smooth medially, finely punctate laterally, apex sharply pointed. Metasternum with anteromedial impression attaining level of hind margin of mesocoxae; width of metacoxa: width of metasternal wing = 2.05 to 2.73. Metafemur length: width = 3.17 to 3.47. Metatibia with an irregular row of separated punctures along almost entire length of inner margin of ventral face, remainder of ventral face impunctate. Metatarsomere 1 with ventral surface bearing a field of coarse setiferous punctures.

Male protarsus with tarsomeres 1 to 3 relatively broadly dilated, protarsal ratio = 2.47: 2.20: 1.80: 1.17: 1.00; protarsomeres 1 to 3 each bearing oval to subquadrate scales beneath; protarsomere 5 with a slight subbasal ventral protuberance (very slight on some specimens) on which ventral setae are best developed; protarsal claws (Fig. 162G) rather elongate, straight basally with apex strongly arcuate, anterior claw with apex laterally flattened and with dorsal margin bent forward so that apex is slightly twisted. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.45 to 0.53. Aedeagus (Fig. 165G, H) of normal proportions, with a subapical ventral spine, not broadened subapically; paramere typical for group.

Ecology. A series from Fitzgerald, Alberta, was collected by J. Carr from a shallow pool on carbonate rock in a road metal pit which had been stripped almost to bedrock along the Salt River. The pond had a thick growth of fine sedges and may have been temporary, a remnant of spring flooding of the nearby river (Larson 1991*b*).

Distribution. Map 206. This species is known from northwestern North America including northern Alberta, western Northwest Territories, Yukon Territory.



Map 206. *Agabus mackenziensis* Larson. Canadian and Alaskan collection localities and United States state records.

98. *Agabus bicolor* (Kirby 1837)

Figs. 162H; 165I, J

Colymbetes bicolor Kirby 1837: 70. Type locality - North America.

Selected References. Larson 1991*b*: 1269 – 1271; Hilsenhoff 1993*c*: 182; Larson 1997*b*: 508.

Description. Length = 6.3 to 8.1 mm; width = 3.4 to 4.3; length: width= 1.79 to 2.00. Size varied, body relatively elongate-oval.

Head black with frontal spots, anterior margin of clypeus and frons above base of each antenna, rufous; antenna testaceous to pale rufous, with distal antennomeres lightly infuscate; palpi rufous with apical palpomere of maxillary palpus lightly infuscate on some specimens. Pronotum black, lateral bead and lateral margin narrowly mesad to bead, rufous; basal margin piceous. Elytron with disc medially, piceous to black; epipleuron and lateral margin broadly rufous to rufopiceous to about level of third row of serial punctures, transition from rufous lateral color to piceous medial area abrupt. Ventral surface mainly black except proepipleuron, prosternal process, metacoxal processes and abdominal sterna 3 to 6 apically, rufous. Legs dark rufous with femora and metatibia mainly piceous.

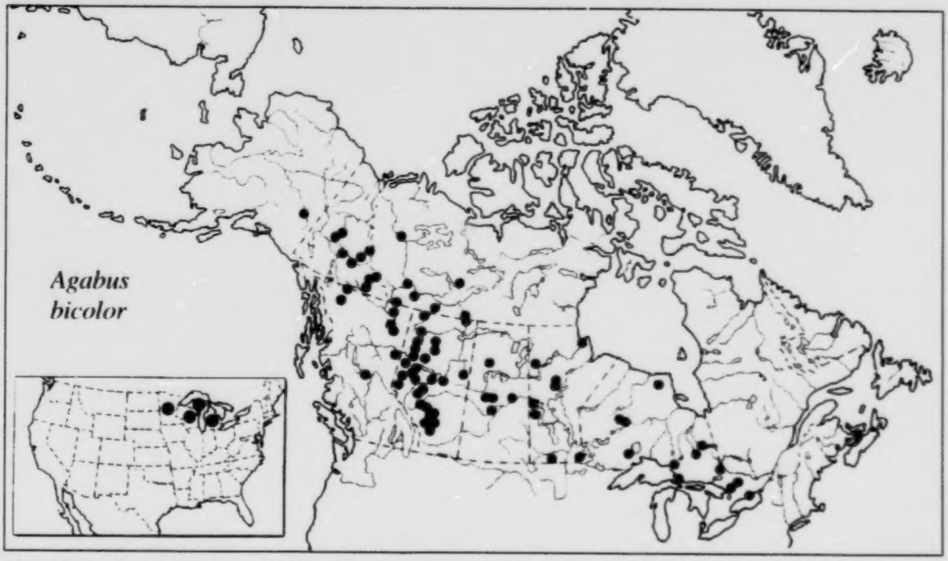
Head and pronotum with sculpture fine, meshes small and rounded but of varied size, especially medially on pronotum; laterally meshes very small, regular and finely granulate; inconspicuous punctures present in lines. Elytron with fine sculpture consisting of small rounded or hexagonal meshes, slightly irregular in shape but more or less similar in size; punctation fine and sparse, each puncture situated medially in a slightly enlarged mesh. Metacoxal plate with small, slightly elongate meshes arranged into irregular longitudinal series by irregular network of slightly deeper lines.

Pronotum with lateral bead of moderate width, widest basally and narrowed towards anterolateral angle, anteriorly mesal portion partly obscured in dorsal aspect by laterally inflated pronotal disc; posterolateral angle somewhat produced. Prosternal process markedly but smoothly convex in cross section, rounded or angulate but not carinate medially. Metasternum with anteromedial impression well developed and extended posterad to level of hind margin of mesocoxal cavities. Width of metacoxa: width of metasternal wing = 2.48 to 3.67. Metafemur length: width = 2.96 to 3.33. Metatibia with punctation various, most specimens with a few small, separated punctures along basal half to two thirds of posteroventral margin. Metatarsomere 1 glabrous ventrally on most specimens, some specimens with one or two accessory setae; slightly longer than longest metatibial spur.

Male with protarsomeres 1 to 3 very slightly broadened, protarsal ratio = 1.47: 1.39: 1.21: 1.06: 1; each tarsomere with elongate, small, adhesive scales on ventral surface. Protarsal claws (Fig. 162H) slender, subequal in length; anterior claw evenly narrowed throughout length with ventral surface very slightly sinuate; posterior claw similar in shape to anterior but ventral sinuation more pronounced. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.53 to 0.60. Aedeagus (Fig. 165I, J) with acute subapical ventral spine, apex distad to spine elongate and slender.

Ecology. This species is usually found in association with sphagnum, most frequently in small, shaded pools where the water is cold to the touch. This is essentially a boreal species that ranges north to the southern limits of the low arctic. Nova Scotian specimens were in a somewhat peculiar habitat, i.e. small, spring-fed peat pools at the edge of forest in the upper end of a salt marsh.

Distribution. Map 207. The range extends from Nova Scotia to Alaska, but the species has been collected frequently only in the northern portion of the prairie provinces.



Map 207. *Agabus bicolor* (Kirby). Canadian and Alaskan collection localities and United States state records.

99. *Agabus subfuscatus* Sharp 1882

Figs. 162I; 165M, N

Agabus subfuscatus Sharp 1882*a*: 514. Type locality - "Am. bor."

Selected Reference. Larson 1991*b*: 1271 – 1272; Hilsenhoff 1993*c*: 189 – 190.

Description. Length = 6.7 to 8.4 mm; width = 3.6 to 4.6 mm; length: width = 1.78 to 1.93. Moderately large and broad.

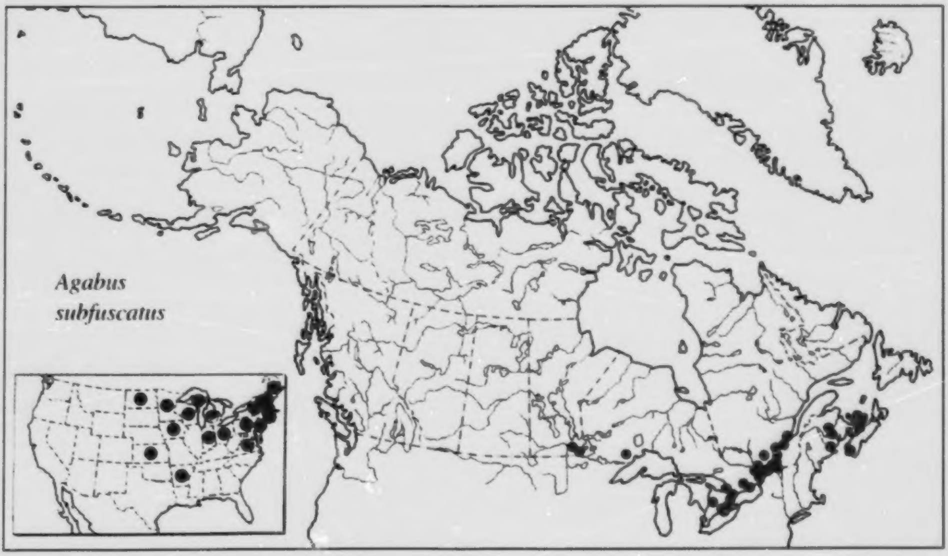
Head black except frontal spots, anterior margin of clypeus and frons above antennae, rufous; mouthparts yellow to reddish, palpi pale with apical palpomere of each palpus lightly infuscate apically; antenna yellow, antennomeres 5 to 11 lightly infuscate apically (sometimes very faintly so). Pronotum black medially; lateral bead translucent, margin mesad to bead narrowly rufous to rufopiceous, pale area merging gradually to black on disc; anterior and posterior borders narrowly piceous. Elytron yellow to yellow brown basally and laterally, darker brown to piceous medially and apically; epipleuron yellow. Ventral surface, including head, mainly black except propleuron laterally, apex of prosternal process, metacoxal processes and sterna 3 to 6 apically, rufous. Legs pale brown to reddish, femora slightly darkened medially.

Head with small meshes of irregular size and shape; inconspicuous punctures present on some meshes and at some intersections of lines. Pronotum with sculpture similar to that of head medially, laterally lines deeper, meshes smaller and more uniform in size but still irregularly granulate. Elytron with meshes small, rounded and of more or less similar size but some meshes slightly irregular in size and shape, at least basomedially, with some fusion of adjacent meshes as well; micropunctures present, inconspicuous on some specimens, each puncture situated medially in an enlarged mesh. Some females with elytral sculpture subgranular, such specimens with meshes smaller, lines deeper, micropunctation less distinct and irregularity of size of meshes less obvious but evident at 100x. Metacoxal plate with well developed network of longitudinal lines, meshes with variously effaced microreticulation.

Pronotum with lateral bead of moderate width, complete onto anterolateral angle and not or only slightly narrowed anteriorly; lateral margin of disc lowly convex mesad to bead and not impinging on bead or hiding it in dorsal aspect. Prosternal process and midline of prosternum in same plane in lateral aspect; process narrow, convex in cross section with convexity either evenly rounded or faintly angulate medially, process most broadly convex basally, convexity stronger and more distinctly angulate apically; surface smooth with fine micropunctures. Width of metacoxa: width of metasternal wing = 2.27 to 2.92. Metafemur length: width = 2.72 to 3.18. Metatibia with punctation of posteroventral margin various, specimens with at least one or two punctures at base, and many specimens with coarser punctures along basal half or even extending into apical half. Metatibial spurs long, longest spur subequal to length of metatarsomere 1. Metatarsomere 1 lacking accessory setae on ventral surface.

Male protarsus narrowly dilated, protarsal ratio = 1.59: 1.44: 1.26: 1.10: 1; protarsomeres 1 to 3 with small oval scales on ventral surface; anterior protarsal claw (Fig. 162I) slightly longer than posterior, relatively broad but little modified; posterior claw with a broad tooth-like medioventral expansion. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.46 to 0.54. Aedeagus (Fig. 165M, N) with a subapical ventral spine; shaft slightly broadened at base of spine in lateral aspect. Paramere normal for group.

Ecology. Most specimens have been collected from eutrophic marshes where emergent sedges and grasses are abundant. The beetles also occur in peatland pools, generally in fen habitat. Teneral specimens have been collected from 12 to 21 June. Flight records are from 19 May to 13 June.



Map 208. *Agabus subfuscatus* Sharp. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 208. The species occurs in southeastern Canada from Nova Scotia to Manitoba, and south in the United States to Virginia, Arkansas and Kansas.

100. *Agabus discolor* (Harris 1828)

Figs. 162J; 165O, P

Colymbetes discolor Harris 1828*b*: 164. Type locality - not stated, Lectotype selected by Larson and Nilsson (1985).

Selected References. Larson 1991*b*: 1272 – 1275; Hilsenhoff 1993*c*: 183 – 184; Larson 1997*b*: 509.

Description. Length = 6.4 to 7.8 mm; width = 3.4 to 4.3; length: width = 1.74 to 1.96. Length moderate, body broadly oval, lateral margins of pronotum and elytron continuous in dorsal aspect on most specimens or some specimens with a slight discontinuity.

Head black dorsally except frontal spots between eyes, clypeus and frons above antennal bases, reddish; mouthparts yellow to red, palpi not infuscate apically; antenna yellow, apical antennomeres lightly infuscate or not. Pronotum black medially; lateral bead translucent, red; disc mesad of lateral bead relatively broadly reddish along entire length with pale area extending mesad to at least top of lateral convexity; anterior and posterior margins piceous. Elytron brown to reddish brown, paler basally and laterally; epipleuron yellow. Ventral surface black except propleuron, prosternal process, metacoxal processes and apical margins of sterna 3 to 6, red. Legs red with femora, and on some specimens metatibia, darkened at least medially.

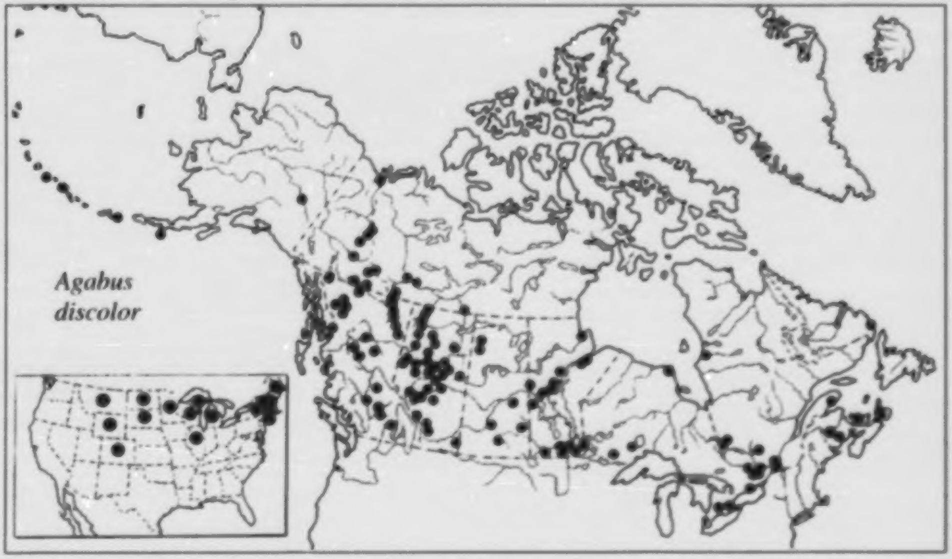
Head dorsally with meshes small, irregular in shape, lines finely impressed except in frontal impressions where they are deeper and sculpture coarser; inconspicuous punctures present in some meshes and in some intersections of lines. Pronotum with small irregular meshes, largest medially and smaller and more granular laterally; small punctures present in some meshes and in intersections of some lines, best seen medially. Elytron with sculpture various, lines fine, meshes small and generally of unequal size and shape over most of disc but some specimens with meshes more or less similar in size and shape apically and laterally but with some irregularity basomedially; very small micropunctation present on some meshes but on many specimens these punctures so small as to be visible only at 100X or greater magnification (specimens from Alaska with punctures more conspicuous and visible at 20X).

Pronotum with lateral bead of moderate width, of more or less even width throughout length and continuous to, or almost to, front angle; disc mesad to bead slightly convex, most noticeably so along anterior half, but not impinging on bead or hiding it in dorsal aspect. Elytron in lateral aspect with dorsal margin more or less straight or very slightly ascending to humeral angle. Prosternal process in same or slightly lower plane than midline of prosternum when viewed in lateral aspect and not noticeably stepped down; process subangularly convex medially but convexity broad, various in height but generally low in cross section; many specimens with process coarsely punctate and setose laterally; apex of process sharply pointed. Metasternum with anteromedial impression well developed and extending posterad to level of hind margin of mesocoxal cavities. Metasternal wings narrow, width of metacoxa: width of metasternal wing = 2.40 to 3.27. Metafemur length: width = 3.02 to 3.19. Metatibia with lateral punctation of ventral face restricted to basal quarter to third on most specimens (some specimens from Aleutian I. with up to 8 punctures along basal half of metatibia). Metatarsomere 1 lacking setae on ventral surface. Micropunctation absent from metatibia and tarsus.

Male protarsus narrowly dilated, protarsal ratio = 1.54: 1.43: 1.26: 1.11: 1; protarsal claws (Fig. 162J) subequal in length to protarsomere 5, anterior claw little modified, posterior claw slightly shorter and narrower than anterior and more evidently sinuate along ventral margin. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.50 to 0.58. Aedeagus (Fig. 165O, P) with a subapical spine, apex distad of spine elongate; in lateral aspect not noticeably broadened subapically.

Ecology. Adult specimens have been collected from small grass or sedge filled pools which are at least semipermanent, and often spring-fed.

Distribution. Map 209. As presently defined, this species is Nearctic but as there are similar forms in the Palaearctic the species may prove to be Holarctic. It is transcontinental and primarily boreal, reaching the southern limits of the low arctic.



Map 209. *Agabus discolor* (Harris). Canadian and Alaskan collection localities and United States state records.

101. *Agabus approximatus* Fall 1922

Figs. 162K; 165Q, R

Agabus approximatus Fall 1922: 26. Type locality - Horsefly Pk, San Miguel Co., Colorado.

Selected References. Larson 1991*b*: 1275 – 1279.

Description. Length = 7.0 to 8.6 mm; width = 3.8 to 4.7; length: width = 1.72 to 1.94. Moderately large, body broadly ovate and outline continuous in dorsal aspect.

Head black except frontal spots and, on some specimens, anterior margin of clypeus narrowly rufous; antenna rufous, apical antennomeres lightly infuscate apically or not; palpi testaceous except terminal palpomere of each palpus lightly infuscate on some specimens. Pronotum with most of disc black, anterolateral angle and disc narrowly adjacent to at least anterior portion of lateral bead, rufous; lateral bead translucent, piceous. Elytron with epipleuron and basal and lateral margins testaceous to pale brown, disc darker brown to reddish brown, rarely piceous, without metallic reflection. Proepipleuron piceous to black at least medially, anterior angle and, on many specimens, lateral margin, rufous; remainder of ventral surface black except metacoxal processes and apex of sterna 3 to 6, rufous. Legs conspicuously variegated; front and middle legs rufous with femora at least basally and ventrally piceous to black; metafemur piceous, metatibia and metatarsus dark rufous.

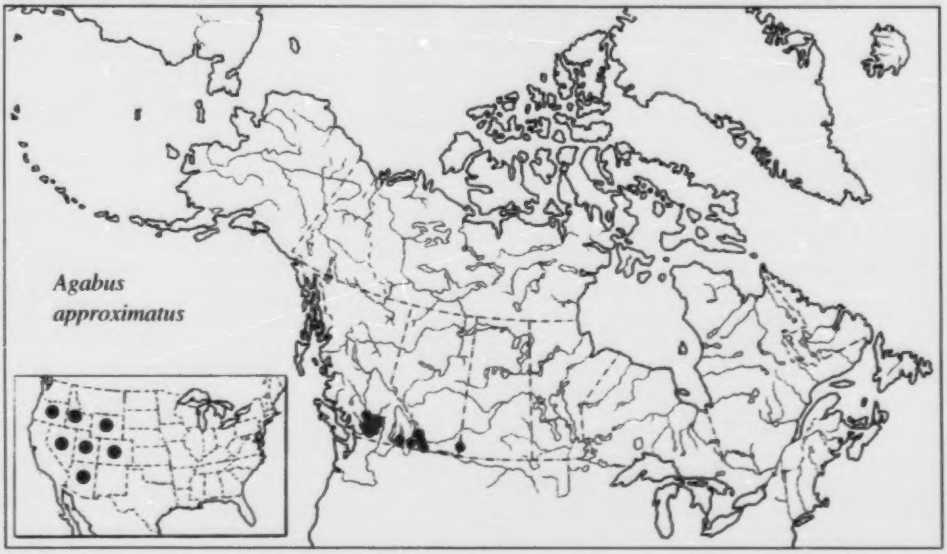
Sculpture of head consisting of moderately large meshes of very irregular size and shape; small punctures present at some intersections of lines and in some meshes. Pronotum medially with sculpture similar to that of head, laterally lines deeper and meshes more rounded and granular but still moderately coarse and of varied size and shape. Elytron with lines fine and meshes smaller than on pronotum, medially meshes highly varied in size and shape with some of the larger meshes bearing a small puncture, laterally and apically meshes of smaller and more regular size although still evidently of varied size and shape. Metacoxal plate with coarse series of lines forming elongate meshes, these in turn with microreticulation which varies from more or less isodiametric to longitudinally stretched. Sternum 6 with moderately coarse transverse lines and rugose meshes, interspaces finely microreticulate.

Pronotum with lateral bead well defined and of more or less equal width throughout length; disc mesad to bead very broadly and gently convex; posterolateral angle not rounded, lateral curvature of pronotum and elytron more or less continuous. Prosternal process more strongly convex medially than midline of prosternum, process basally more or less carinate, medial ridge narrowly rounded, sides laterad to midline of ridge impressed and concave on most specimens thus midline and lateral bead more prominent than in related species; process glabrous, finely and sparsely punctate; apex acute, received into well impressed anteromedial impression of metasternum. Metasternal wing moderately broad, width of metacoxa: width of metasternal wing = 2.00 to 2.61. Protibia expanded apically, outer margin straight to distinctly arcuate, protibia Length: width = 2.82 to 3.33. Metafemur length: width = 3.05 to 3.67; metatibia with posteroventral margin lacking punctures or with a few small, irregularly spaced punctures in basal half; length longer metatibial spur: length of metatarsomere 1 = 0.67 to 0.75. Metatarsomere 1 lacking accessory ventral setae.

Male protarsomeres narrowly dilated, protarsal ratio = 1.61: 1.48: 1.26: 1.06: 1; anterior protarsal claw (Fig. 162K) subequal to or slightly longer than metatarsomere 5 (length of claw to length of protarsomere 5 = 0.95 to 1.13); claw in lateral aspect more or less evenly arcuate; posterior claw slightly shorter and narrower, its ventral margin slightly sinuate. Mesotarsus with tarsomere 1 subequal in length to tarsomere 5, Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.42 to 0.51. Aedeagus (Fig. 165Q, R) of varied shape, most specimens with shaft in lateral aspect of more or less even width throughout length, subapical ventral spine large.

Ecology. In Alberta, the species occurs in small, slow flowing foothill creeks and springs and in spring-fed pools (Larson 1975). The habitat elsewhere has not been recorded but in the southern part of the range specimens have been taken at high elevations. Locality records are consistent with the species occurring primarily in grassland habitats. The larva described by Nilsson (1983*b)* as *A. approximatus* is actually that of the Palaearctic *A. levanderi*.

Distribution. Map 210. The range extends from southern British Columbia and foothills of southern Alberta to southern Colorado, northern Arizona, Nevada and Oregon.



Map 210. *Agabus approximatus* Fall. Canadian and Alaskan collection localities and United States state records.

102. *Agabus kootenai* Larson 1991

Figs. 162L; 165U, V

Agabus kootenai Larson 1991*b*: 1279 – 1281. Type locality - British Columbia, Mt. Revelstoke, 5800'.

Selected References. Larson 1975: 365 (as *Agabus* species near *A. approximatus*); Larson 1991*b*: 1279 – 1281.

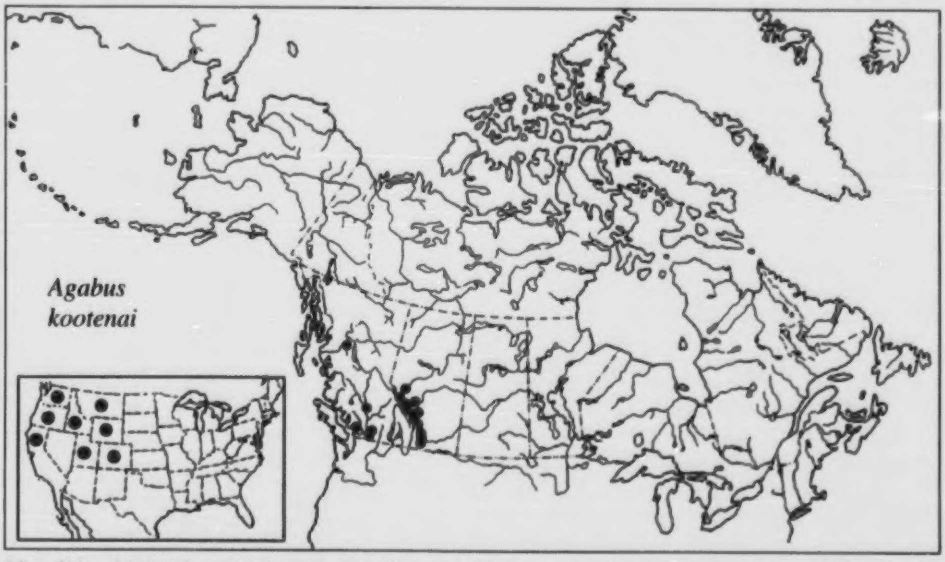
Description. Length = 6.7 to 8.4 mm; width = 3.6 to 4.6 mm; length: width = 1.72 to 1.96. Medium size, body somewhat elongate, shape various, many specimens with body outline evidently discontinuous between pronotum and elytra.

Color of head black except frontal spots red, anterior margin of clypeus rufous; mouthparts yellow, palpi yellow with apical palpomere of each palpus infuscate apically; antenna yellow, antennomeres 5 to 11 infuscate apically; ventral surface of head black. Pronotum black medially; lateral bead translucent, reddish-piceous; margin mesad to bead piceous to narrowly red, width of pale area about equal to width of a middle antennomere, anterolateral angle distinctly paler and with pale area broadened; anterior and posterior margins piceous. Elytron with basal and lateral margin yellow to pale brown, disc medially and apically darkened, darker usually reddish brown; epipleuron yellow. Ventral surface with proepipleuron various in color, yellow with a posteromedial piceous cloud, or largely piceous with anterior angle paler, yellow; remainder of ventral surface black except metacoxal processes and apical margin of sterna 3 to 6, rufous. Front and middle legs rufous with at least medial and ventral portion of femora dark brown to piceous; hind legs darker rufous to piceous.

Head medially with sculpture consisting of moderate sized meshes of irregular shape and size; sparse inconspicuous punctures present in some meshes and at intersections of some lines. Pronotum with sculpture similar to that of head, laterally mesh size and shape irregular although rounded. Elytron with lines slightly finer than those of pronotum, forming very irregular meshes over entire surface; scattered punctures present in some meshes but not conspicuous. Metacoxal plate with coarse, more or less longitudinal meshes, these in turn rugose or irregularly microreticulate.

Pronotum shape various, many specimens with lateral margin in dorsal aspect more arcuate than that of elytron so that lateral outline of body is distinctly discontinuous in curvature, with posterolateral angle narrowly rounded and obtuse; other specimens with pronotum and elytra more or less evenly rounded and hind angles of pronotum more acute. Pronotal bead well developed along entire length, slightly narrowed anteriorly or not; sublateral portion of disc flat to broadly and lowly convex but convexity not impinging on bead or hiding it in dorsal aspect. Prosternum and its process strongly and angularly convex medially, convexity continuous between prosternum and process, tectiform but narrowly rounded medially and not carinate, sides laterad of medial convexity not distinctly concave. Metasternal wings broad, width of metacoxa: width of metasternal wing = 1.89 to 2.65. Protibia length: width = 2.86. Metafemur length: width = 3.37.

Male protarsus narrowly dilated, protarsal ratio = 1.55: 1.47: 1.21: 1.02: 1; protarsal claw (Fig. 162L) relatively large, length protarsal claw/ length protarsomere 5 = 0.98 to 1.22. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.48 to 0.58. Aedeagus (Fig. 165U, V) with a subapical ventral spine, apex distad of spine elongate.



Map 211. *Agabus kootenai* Larson. Canadian and Alaskan collection localities and United States state records.

Ecology. The species is found at high altitudes, in the subalne and alpine zones. Specimens occur in small, cold, often spring or seepage-fed pos. Such pools usually have peaty bottoms and are surrounded by mosses and *Juncus* osedges.

Distribution. Map 211. The range extends along the Rocky Muntains from western Alberta to Colorado, and west to the Pacific in southern ritish Columbia and Washington and the Sierra Nevada Mountains of California.

103. *Agabus inscriptus* (Crotch 1873

Figs. 162M;165W, X

Gaurodytes inscriptus Crotch 1873: 422. Type locality - Labrad

Selected References. Larson 1991*b*: 1281 – 1284; Hilsenhf 1993*c*: 186; Larson 1997*b*: 509.

Description. Length = 5.9 to 7.5 mm; width = 3.1 to 4.1 mmength: width = 1.75 to 1.96. A relatively small species, body ovate, outline continuoun dorsal aspect.

Head black except frontal spots between eyes and antrior margin of clypeus, red; mouthparts yellow, palpi yellow with apex of termin palpomere faintly to distinctly infuscate; antenna yellow with at least apical anteromere infuscate (some specimens with infuscation beginning on antennomere 5). Prontum black; lateral bead translucent and disc mesad of lateral bead piceous to black (ry narrowly rufous on some specimens), anterolateral angle reddish. Elytron reddh brown laterally and basally, darker brown to piceous medially and apically; epleuron yellow. Ventral surface of body largely black except propleuron dark rufous piceous or black with anterior angle paler, reddish; metacoxal processes and posterionargins of sterna 3 to 6, reddish. Legs reddish with femora piceous, at least mediallyand metatibia of many specimens dark and similar in color to metafemur or only sligly paler. Legs darker in color than in *A. discolor* with difference in color between metamur and metatibia less evident.

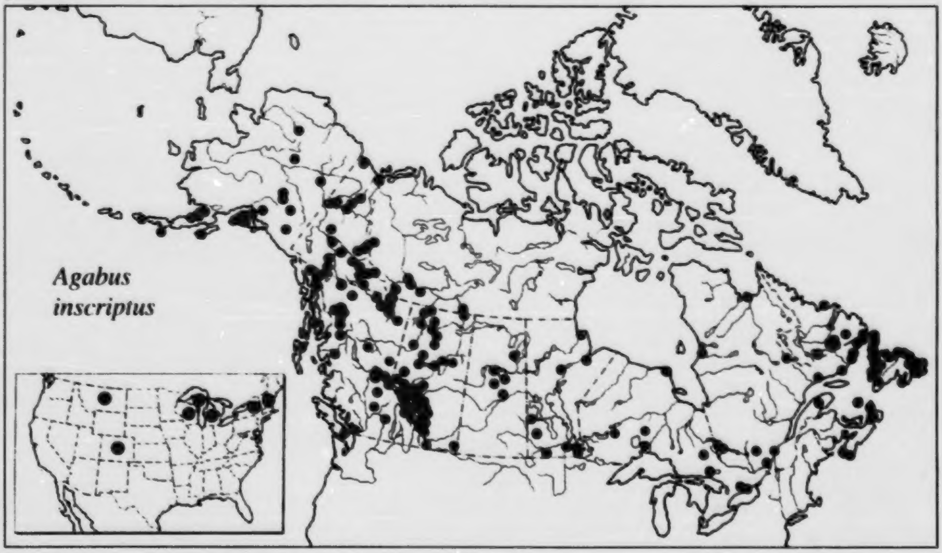
Head with small irregular meshes; some meshes with conspicuous punctures, best seen along posterior margin of frons, also some intersectis of lines with a small puncture in each. Pronotum with small, irregular meshes, mnes small and granular laterally, larger and flatter medially on disc; scattered sparse pctures present both on meshes and in lines at intersections. Elytron with sculpture vious, meshes small, on most specimens of irregular size and shape at least basomedily but some specimens with meshes rounded and more or less isodiametric over ost of disc except in basomedial area where some irregularity is evident.

Clypeus with anterior bead complete. Pronotum with laral bead of more or less even width throughout its length; disc mesad of bead more oless flat or with a very slight convexity, best developed along anterior half of lateral rgin but not impinging upon lateral bead or hiding it in dorsal aspect. Elytron with laral margin straight and not ascendant to humeral angle in lateral aspect; epipleuron shtly impressed posterad to humeral angle. Prosternum and its process distinctly convex cross section, medially with convexity sharper and more or less angulate; process on mre or less same plane as midline of prosternum in lateral aspect; process glabrous andt most finely punctate. Metasternum with anteromedial impression extending posterato level of hind margin of mesocoxae; width of metacoxa: width of metasternal wing = 2.06 to 2.88. Metafemur length: width = 2.89 to 3.50. Metatibia with punctation of hind margin of ventral face various, ranging from impunctate to as many as 6 punctures scattered along basal half to two-thirds of length. Metatarsomere 1 lacking accessory setiferous punctures on ventral face.

Protarsus narrowly dilated, protarsal ratio = 1.55: 1.45: 1.27: 1.12: 1; protarsal claws (Fig. 162M) subequal to or slightly shorter than protarsomere 5; posterior claw slightly shorter and narrower than anterior, with a slight basoventral emargination on many but not all specimens. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.51 to 0.56. Aedeagus (Fig. 165W, X) with a subapical ventral spine, shaft not evidently dilated subapically at level of base of spine; apex distad of spine relatively short.

Ecology. These beetles are common in bog and fen pools throughout the boreal zone. This is the most common species of *Agabus* in small sphagnum-ringed pools on the coastal barrens of Newfoundland and Labrador. As well, the species occurs in small, cold, moss-ringed pools in coniferous forest and is the only species of *Agabus* that occurs regularly with *A. elongatus*.

Distribution. Map 212. The distribution is transcontinental in the boreal and northern alpine regions of North America. There are few arctic locality records although specimens have been found in alpine pools in the Rocky Mountains as well in small pools on the coastal barrens of Newfoundland and Labrador.



Map 212. *Agabus inscriptus* (Crotch). Canadian and Alaskan collection localities and United States state records.

104. *Agabus smithi* Brown 1930

Figs. 162N; 165S, T

Agabus smithi Brown 1930*a*: 88. Type locality - Copper Mtn., BC.

Selected Reference. Larson 1991*b*: 1284 – 1285.

Description. Length = 6.1 to 7.5 mm; width = 3.3 to 3.9 mm; length: width = 1.75 to 1.96. Small to moderate size, shape ovate, body outline continuous in dorsal aspect.

Head black except frontal spots and anterior margin of clypeus, rufous; mouthparts yellow, apical palpomere of each palpus lightly infuscate on most specimens; antenna yellow with outer antennomeres lightly infuscate. Pronotum with disc black, lateral bead translucent, red to piceous, anterolateral angle and on some specimens disc narrowly mesad to bead, reddish to piceous. Elytron color various, most specimens more or less evenly reddish brown but some specimens with disc darkened medially and apically, dark brown to piceous; epipleuron yellow. Ventral surface mainly black; propleuron paler anteriorly and laterally otherwise mainly piceous; metacoxal processes apically and apical margins of sterna 3 to 6 rufous. Legs reddish with femora dark brown to piceous at least medially; metatibia on many specimens distinctly paler than metafemur.

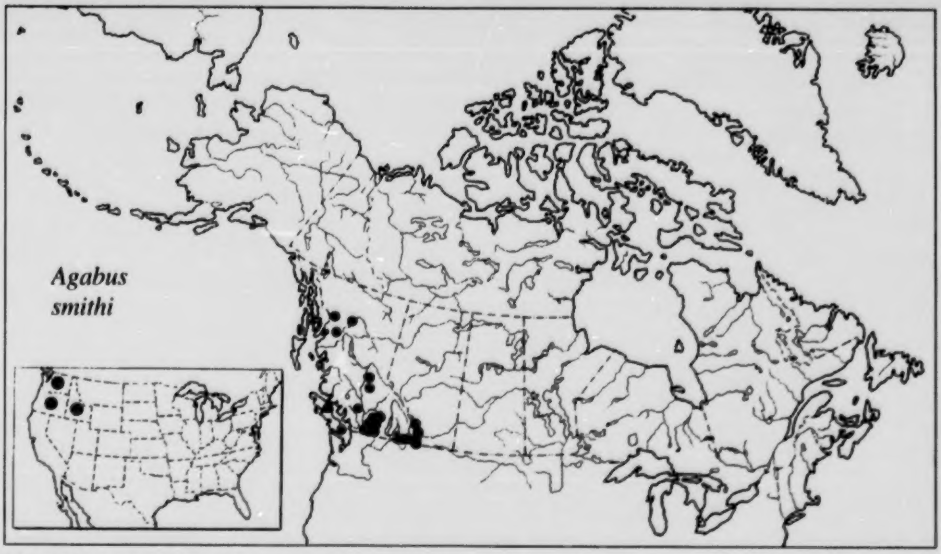
Head with moderate sized, irregularly sized and shaped meshes; micropunctures present in some lines and also on some meshes and more conspicuous than on similar species. Pronotum with meshes relatively large; medially near medial fovea meshes longitudinally stretched on most specimens, laterally meshes more irregular in size and shape and without definite orientation; laterally lines deeper and meshes more or less granular; fine micropunctation present over most of disc, that on meshes most conspicuous but micropunctures also present in lines. Elytron with sculpture various, ranging from fine, rounded meshes to meshes of obviously unequal sizes and shapes; however, all specimens with meshes basomedially of at least slightly varied size and not perfectly regular or isodiametric; entire disc with numerous more or less evenly spaced fine micropunctures, each situated medially on an enlarged mesh.

Palpi relatively slender. Pronotum with lateral bead of moderate width, complete and of even width throughout; disc mesad to bead more or less flat to slightly and shortly convex but not swollen or hiding bead in dorsal aspect. Elytron in lateral aspect with lateral margin straight. Prosternal process various, convex, on most specimens distinctly subangulate to subtectiform; finely and densely punctate laterally. Metasternal wing broad, width of metacoxa: width of metasternal wing = 1.71 to 2.33. Metafemur length: width = 3.11 to 3.46. Metatibia with posterolateral series of punctures variously developed, with from 0 to 11 punctures, most specimens with punctures distributed along almost entire length of metatibia; mesal face impunctate.

Male protarsus narrow, protarsal ratio - 1.56: 1.45: 1.27: 1.13: 1; protarsal claws (Fig. 162N) subequal to length of protarsomere 5, anterior claw slightly longer than posterior. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.49 to 0.56. Aedeagus (Fig. 165S, T) as in *A. inscriptus* but with apex slightly longer beyond base of subapical spine.

Ecology. Specimens have been collected from small pools and marshes in montane forest from low to moderate elevations. No label data suggest occurrence in alpine habitats.

Distribution. Map 213. The species has a limited distribution in southern British Columbia, southwestern Alberta, northern Idaho, Washington and Oregon.



Map 213. *Agabus smithi* Brown., Canadian and Alaskan collection localities and United States state records.

105. *Agabus sasquatch* Larson 1991

Figs. 162O; 165Y, Z

Agabus sasquatch Larson 1991: 1285 – 1287. Type locality - California, Fresno Co., stagnant pond by Bear Cr. 9600 ft.

Selected Reference. Larson 1991*b*: 1285 – 1287.

Description. Length = 6.7 to 8.1 mm; width = 3.7 to 4.2 mm; length: width = 1.77 to 1.95. Moderately small, elongate-oval, lateral margin of pronotum and elytron continuous in dorsal aspect.

Head black except fontal spots red; labrum yellow; antenna yellow with apical antennomeres lightly infuscate apically; palpi yellow, apical palpomere of each palpus lightly infuscate apically. Pronotum black medially, lateral bead and disc mesad to bead (width about twice width of bead) red with mesal limits of red area rather abrupt; anterior and posterior margins also narrowly rufous; epipleuron rufous with medial area infuscate. Elytron yellow to reddish brown, palest basolaterally and darkened medially and apically; epipleuron yellow. Ventral surface of body mainly black except apex of metacoxal processes and hind margin of sterna 3 to 6, rufous. Legs rufous to rufopiceous with pro-and mesofemora medially and hind legs darkened.

Sculpture of head and pronotum consisting of moderate lines forming meshes of irregular size and shape; meshes smaller and more rounded laterally on pronotum; minute punctures present on some meshes. Elytron with meshes small, rounded but of at least slightly varied size and shape, at least basomedially ; however, on some specimens with relatively deeply impressed lines meshes are finely granular and rounded; some meshes with a small, medial puncture. Metasternal wing relatively shiny, sculpture lightly impressed; metacoxal plate duller with dense longitudinal lines forming irregular longitudinal meshes which in turn are rugose or with irregular secondary lines.

Metafemur with longitudinal lines slightly deepened at punctures to form short slits, not distinctly striolate. Abdomen with longitudinal or oblique strioles, interspaces with fine longitudinal lines and fine punctures; sternum 6 with moderately coarse, more or less transverse lines and meshes.

Pronotum with anterior transverse row of punctures more or less complete; posterior row broadly broken medially; anterior pronotal bead obsolete medially; lateral bead of moderate width, well delimited and of more or less uniform width throughout its length; disc gently and evenly convex mesad to bead and not impinging on it or hiding it anteriorly in dorsal aspect; hind margin of pronotum rounded in a more or less even, broad arc; posterolateral angle narrowly rounded apically, slightly obtuse. Elytron in lateral aspect with epipleuron hidden behind lateral margin well posterad of shoulder. Prosternum and its process strongly longitudinally convex medially, tectiform with apex of convexity narrowly rounded; convexity similar on both but slight stronger on process; process in slightly lower plane than midline of prosternum but descent smooth; process shiny, small sparse punctures deeper laterally; apex acuminate, received into deeply impressed metasternal impression which on most specimens does not quite attain level of hind margin of mesocoxal cavities. Width of metacoxa: width of metasternal wing = 2.30 to 2.70. Metafemur length: width = 3.12 to 3.65. Metatibia with hind margin impunctate, ventral face with a few small punctures at base otherwise impunctate or with only a few very minute punctures. Metatibial spur slightly shorter than metatarsomere 1. Metatarsomere 1 lacking accessory setae on ventral surface.

Male protarsomeres narrowly dilated, protarsal ratio = 1.49: 1.41: 1.20: 1.08: 1; protarsal claws (Fig. 162O) subequal in length, about 1.1x as long as protarsomere 5; claws slender, similar in shape but posterior claw narrower than anterior. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.48 to 0.50. Aedeagus (Fig. 165Y, Z) similar to that of *A. smithi*, ventrobasal margin with flattened area short and restricted to basal portion; paramere with apical lobe various but relatively slender and elongate on at least some specimens.

Ecology. Label data indicate the species occurs in small ponds at high elevation (2350 to 3800 m). A teneral specimen was collected 25 May and slightly teneral specimens 29 July.

Distribution. The species is known only from alpine areas in California and Nevada.

106. *Agabus confinis* (Gyllenhal 1808)

Figs. 161; 162P; 165A^1, B^1

Dytiscus confinis Gyllenhal 1808: 511. Type locality - Sweden.

Selected References. Larson 1991*b*: 1287 – 1289; Hilsenhoff 1993*c*: 183; Nilsson and Holmen 116 – 117; Larson 1997*b*: 508.

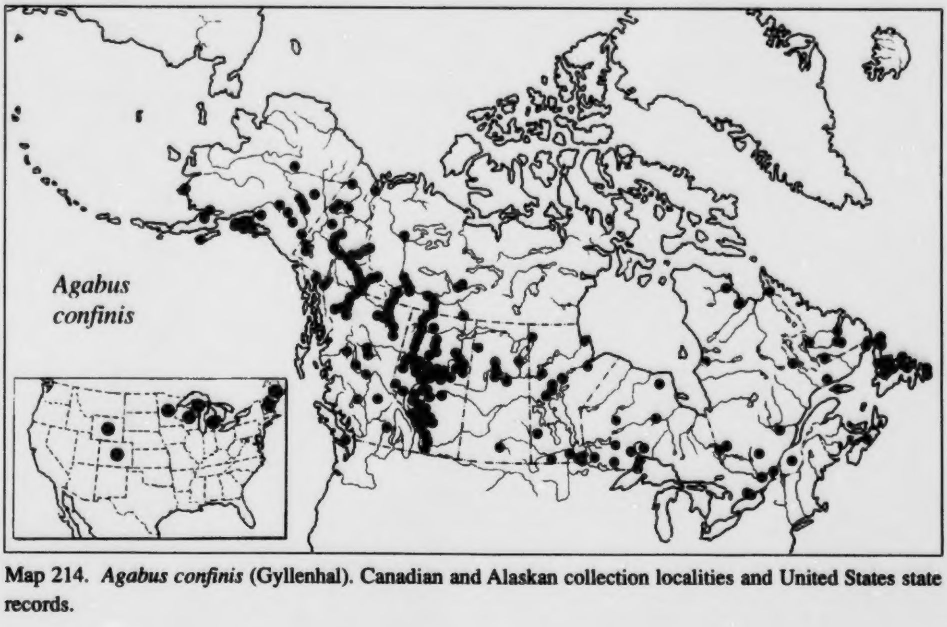
Description. Length = 7.8 to 9.2 mm; width = 4.2 to 4.9 mm; length: width = 1.73 to 1.94. A moderately large species, body outline continuous (Fig. 161).

Head black except frontal spots, anterior margin of clypeus, and labrum, rufous; antenna pale rufous, outer antennomeres lightly infuscate apically; palpi pale, terminal palpomere of each palpus lightly infuscate apically on most specimens. Pronotum black except lateral bead and anterolateral angle dark rufous to piceous. Elytron dark brown to piceous, lateral margin and epipleuron pale brown to light rufous. Ventral surface mainly black. Legs rufous to piceous.

Head with small meshes of irregular size and shape. Pronotum medially with small meshes of varied size and shape. laterally meshes smaller and more rounded but size and shape various. Elytron with sculpture fine, meshes small and rounded but with some variation size and shape, especially basomedially; meshes more regular laterally and apically; very fine sparse punctation present, each puncture situated centrally in a mesh. Metacoxal plate with fine dense lines which form elongate meshes on at least lateral half of plate, meshes with variously effaced microreticulation.

Pronotum with lateral bead of moderate width, well defined and of more or less equal width throughout length; anterior sublateral margin of disc not inflated mesad of bead. Prosternal process medially raised into a strong longitudinal carina, crest of carina narrowly rounded; sides laterad of carina concave; apex sharply. Metasternal impression not extending posterad to level of hind margin of mesocoxal cavities but attaining level of hind margin of mesocoxae. Width of metacoxa: width of metasternal wing = 1.98 to 2.58. Metafemur length: width = 3.1 to 3.7; finely and sparsely punctate, some specimens with a few very short and fine strioles. Metatibia with punctures along posteroventral margin various, ranging from as few as three or four punctures on basal quarter to a more or less continuous row of punctures along basal two-thirds. Metatarsomere 1 slightly longer than longest metatibial spur; glabrous beneath or occasional specimen with one or two ventral setae.

Male protarsomeres 1 to 3 slightly broadened, protarsal ratio = 1.51: 1.41: 1.24: 1.05: 1; each with small adhesive scales on ventral surface; protarsal claws (Fig. 162P) similar in shape, slender and only very slightly sinuate ventrally; anterior claw .9 to 1.2x length of protarsomere 5. Mesotarsomere 5 length: combined length mesotarsomeres 1 to 4 = 0.53 to 0.57. Aedeagus (Fig. 165A^1, B^1) with a ventral subapical spine, apex various in degree of reflexion; not broadened subapically.



Map 214. *Agabus confinis* (Gyllenhal). Canadian and Alaskan collection localities and United States state records.

Ecology. This species occurs in small pools, usually where the water is shaded by dense growths of emergent plants, usually *Carex*, and is cool. It is a common species in peatland pools. In Sweden, Nilsson (1986*a)* found it most commonly in temporary, open ponds. The larva has been described (Nilsson 1980) and keyed with other Fennoscandian species of *Agabus* (Nilsson 1982*b*, 1987*b)*. The life history is similar to that of other members of the group. Eggs laid in the spring do not hatch until the following spring. Larvae complete development the summer of hatching and emerging adults overwinter, on land, before laying eggs in the spring (Nilsson 1986*a)*.

Distribution. Map 214. *Agabus confinis* has a wide distribution in the boreal portions of the Holarctic region. The northern limits are the southern edge of the arctic region. It occurs along the Rocky Mountains to central Colorado.

Genus *Carrhydrus* Fall 1923

Figs. 166A, B; 167

Carrhydrus Fall 1923: 35. Type species - *Carrhydrus crassipes* Fall, by monotypy.

Diagnosis. Moderately large, length = 10.5 to 13.5 mm, dorsally strongly convex, body in dorsal aspect (Fig. 166A) with outline continuous, oval but shape sexually dimorphic. Color reddish brown to piceous. Sculpture of elytron small, rounded meshes with evident punctation.

Clypeus with anterior margin finely but completely margined. Eye emarginate above base of antenna. Labial palpus with penultimate palpomere expanded and triangular in cross-section with faces more or less concave, dorsal surface with a sharp ridge which lies below a series of longitudinal ridges on submentum. Pronotum with lateral bead. Prosternum and its process in same plane, process elongate and slender and received into deeply impressed groove on anteromedial lobe of metasternum which extends posteriorly to level of hind margin of mesocoxal cavities. Mesosternum large and prominent. Metacoxal lines divergent anteriorly; metacoxal lobes rounded laterally, slightly (female) to strongly (male) produced medially (Fig. 166B). Metafemur with a linear comb of setae on ventroapical angle; metatarsomeres with external apical angles very slightly and broadly lobed; metatarsal claws unequal, dorsal claw about one-half length of ventral claw. Female lacking natatorial setae on metatibia and external margin of metatarsomeres.

Male with strongly developed secondary sexual characters on antennae (Fig. 166A), legs and metasternum; parameres (Fig. 167B) broad, longer than aedeagus, densely setose; aedeagus (Fig. 167C, D) short, slender and simple. Female gonocoxae (Fig. 167E) short, triangular, setose apically and not adapted for piercing or sawing.

Comments. This genus contains a single species. Its relationships are discussed below under species comments. The peculiar structure of the penultimate labial palpomere has been interpreted as the plectrum of a stridulatory organ which is formed by the dorsal ridge of the palpomere passing over a series of longitudinal ridges (file) on the adjacent submentum (Larson and Pritchard 1974). However, there are as yet no behavioural observations to support this hypothesis which is based on the close alignment of the plectrum and file.

Carrhydrus crassipes Fall 1923

Figs. 166; 167

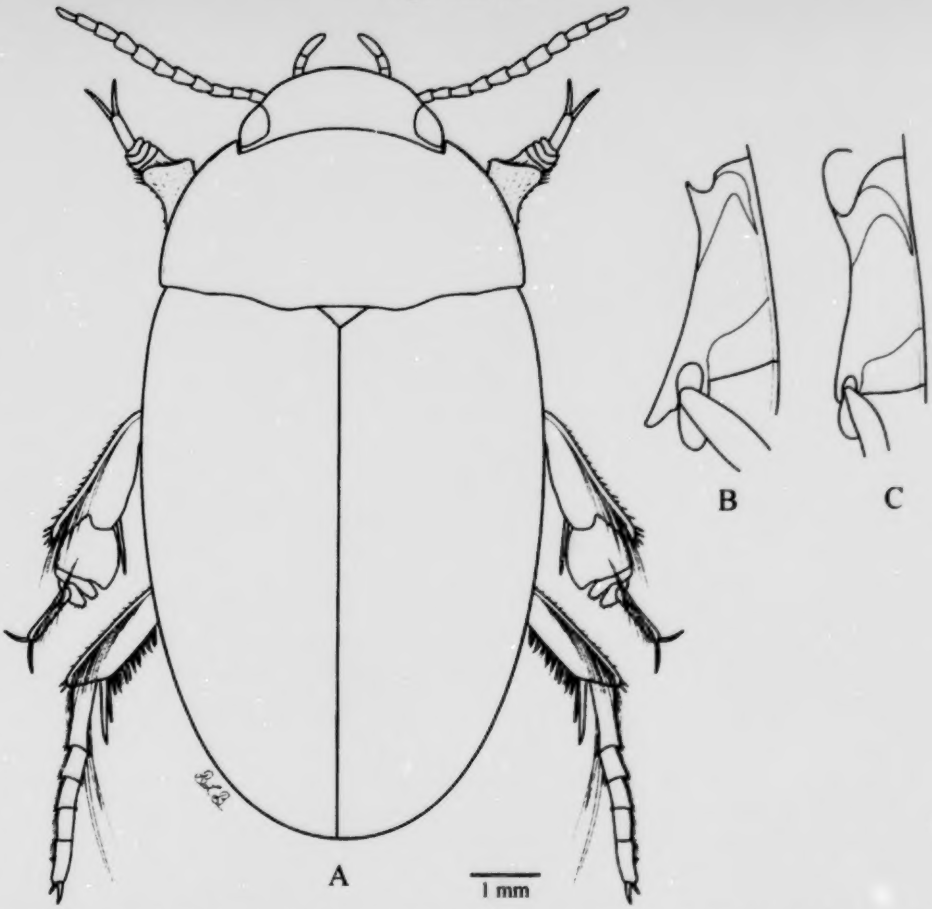


Fig. 166. A, B - *Carrhydrus crassipes*, male. A - habitus. B - metathorax, left side, lateral. C - *Agabus serricornis*, metathorax, left side, lateral.

Carrhydrus crassipes Fall 1923: 35. Type locality - Edmonton, Alberta.

Selected References. Leech 1942*a*: 361; Larson 1975: 369 – 370; Larson 1997*b*: 511.

Description. Sexually dimorphic in size and shape. Male larger, length = 11.7 to 13.5 mm; width = 6.4 to 7.0 mm; length: width = 1.80 to 1.95. Female length = 10.5 to 11.6 mm; width = 5.5 to 6.3 mm; length: width = 1.84 to 1.93. Male (Fig. 166) with point of maximum width near base of elytra, female more ovate with maximum width near middle of elytra.

Body piceous to almost black medially on disc of pronotum and elytra; head, lateral margins of pronotum and elytra dark rufous; antenna and palpi rufous; ventral surface piceous with prothorax, metacoxal processes and apical margins of abdominal sterna rufous and legs reddish brown to rufopiceous. Female generally slightly darker than male.

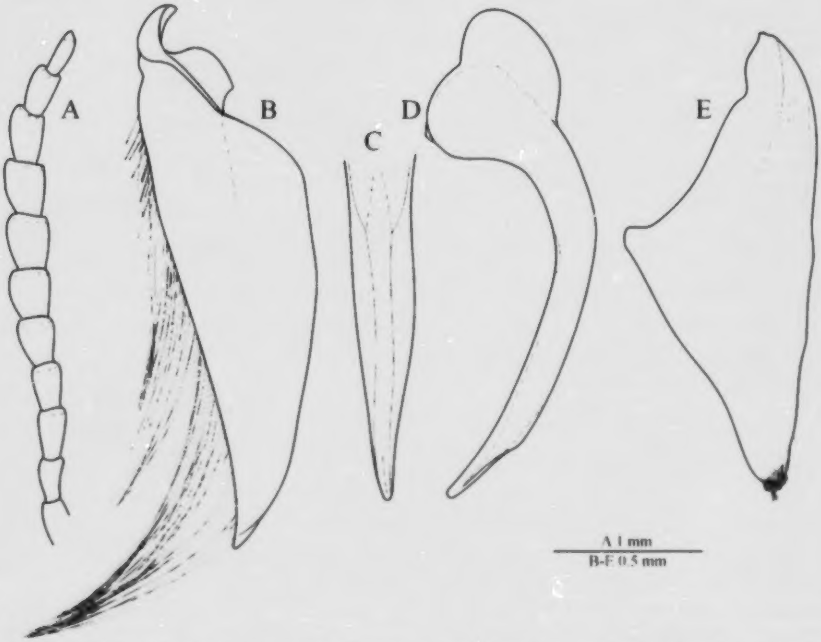


Fig. 167. *Carrhydrus crassipes*. A - male antenna. B - paramere. C - aedeagus, dorsal. D - aedeagus, lateral. E - female gonocoxa.

Sculpture of head and pronotum consisting of small meshes of irregular shape and orientation; meshes finer laterally; fine punctures present, primarily at intersections of lines. Elytron with fine, rounded, more or less isodiametric meshes which may appear somewhat granular; numerous small punctures present. Metacoxal plate with irregular anastomosing strioles, metafemur evidently punctate, without strioles; metatibia irregularly punctate basally, with few or no punctures along hind margin, mesal face micropunctate; metatarsomeres glabrous dorsally.

Prosternum and its process in same plane, tectiform in cross-section; process with apex elongate and narrow. Metasternal wings narrow, width metacoxa: width of metasternum = 3.57 to 4.00 (generally lower values for female than male); metacoxa with anterior margin extending anteriorly almost to level of hind margin of mesocoxal cavities.

Male with many secondary sexual characters. Antennomeres 5 to 10 broadened laterally, flattened ventrally (Fig. 167A). Front and middle legs strongly modified, middle legs most strongly so; profemur strongly dilated apically, outer margin sinuate and apicolateral angle produced; protarsomere 1 very large and triangular in dorsal aspect, protarsomeres 2 and 3 short and transverse, each with numerous small rounded adhesive setae on ventral surface; protarsomere 5 triangular in lateral aspect with base broad and narrowing apically, claws elongate, posterior claw longer and broader than anterior; middle leg similar to front leg but with femur larger, metatibia strongly and evenly dilated apically with outer margin more or less straight even to apex of prolonged apicolateral angle, mesotarsomere 1 very large, mesotarsomeres 2 and 3 short and transverse; mesotarsomeres 4 and 5 and mesotarsal claws not modified. Metasternum in lateral aspect with midline concave (Fig. 166B), metacoxal processes prolonged posteriorly and ventrally and forming an even arc with concave metasternum (Fig. 166B). Metatibia with dense brush of setae along posterior margin; metatarsomeres each with a setose brush on outer margin, least developed on metatarsomere 2; metatarsomere 1 elongate, and subparallel, subequal in length to combined lengths of 2 and 3; metatarsomere 5 broad basally, outer margin concave and tarsomere narrowed in apical half. Genitalia as described above.

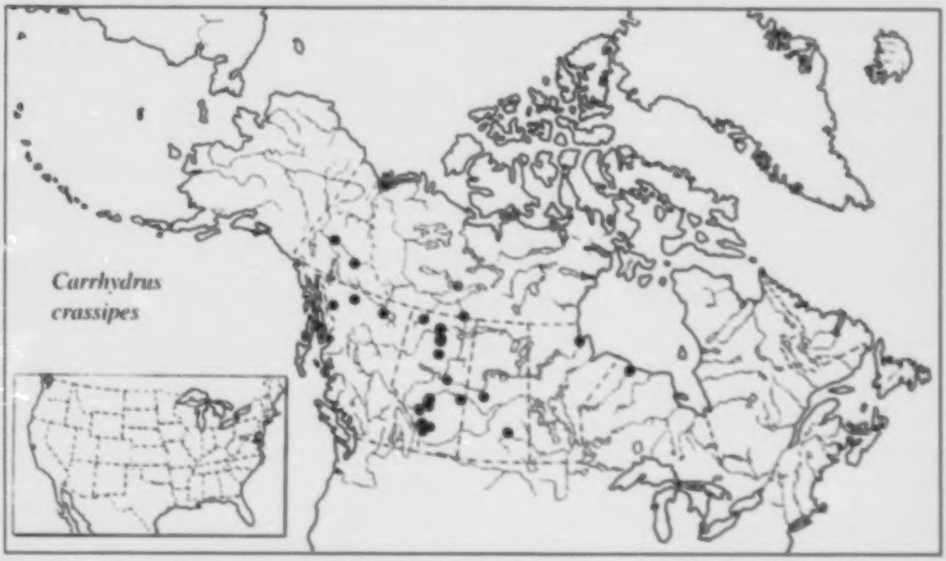
Comments. Larson (1975) discussed the systematic position of *Carrhydrus* and pointed out similarities *C. crassipes* shares with members of the *Agabus clavicornis*-group. Similarities with one or more members of the *A. clavicornis*-group include the narrow but complete anterior margin of the clypeus, strongly developed sexual dimorphism, expanded male antenna, relatively strongly developed mesosternum, narrow metasternal wings, concave metasternum (Fig. 166B, C), heavy front and middle legs, broad dorsally convex pro- and mesotarsomeres 1, presence of setose brushes on the hind margin of the metatibia and along the hind margins of the metatarsomeres, elongate metatarsomere 1, broad parameres and relatively small aedeagus. This suite of characters forms a strong case for including *C. crassipes* in the *A. clavicornis*-group and indicates that the unequal metatarsal claws are secondarily derived. On the other hand, there is a tendency within the Dytiscidae for modifications of the antennae to occur in concert with the existence of setal brushes and unusual modifications of the legs (e.g., within *Laccornis* and *Heterosternuta diversicornis* Sharp within the North American fauna). Ribera (1994) also noted that sexual dimorphisms are in general species autapomorphies and not synapomorphic for higher clades.

Carrhydrus is maintained as a separate genus because there is a possibility, although slight, that the similarities with certain *Agabus* species are convergent and represent a suite of characters associated with some sort of similar reproductive behaviour. Also, the name is retained for sentimental rather than purely scientific reasons. This large, spectacular and rather uncommon species is one of the best prizes a collector can hope to take and the recognition of a monotypic genus for it reflects the singular nature of the insect. Also, the name *Carrhydrus* is a most suitable monument to the contributions which the Carr family of Alberta have made to the knowledge of Nearctic water beetles.

Ecology. These insects occur in permanent ponds in parkland and boreal forest regions. The beetles occur in mats of floating, usually dead and decaying, *Carex* or grass stalks, and usually in relatively deep water of 20 to 100 cm depth. This habitat is found frequently in newly formed beaver ponds as well as road-side ponds where drainage has been impeded. Interestingly, the insects are almost always found in aggregations where a number of specimens occur within an area of only a few square metres.

Although nothing is known of the reproductive behaviour, it is interesting to speculate on some of the elements that might be involved. The short aedeagus suggests that the male's body must be closely appressed to the female, which is possible due to the concavity provided by the impressed metasternum and extended metacoxal processes. The enlarged pro- and mesotarsomeres would aid the male in clinging to the back of the female while the setose brushes may have a courtship function. To top it off, the palpal stridulatory organ may produce a courtship serenade. However, as the stridulatory organ is similarly developed on both sexes, its roll may be related to the maintenance of the aggregations. Regardless of whether these speculations are correct, the behavioural ecology of this insect would appear to be well worthy of investigation.

Distribution. Map 215. Collection records extend from western Ontario to the Alberta foothills and the southern Yukon Territory.



Map 215. *Carrhydrus crassipes* Fall. Canadian and Alaskan collection localities and United States state records.

Genus *Ilybius* Erichson 1832

Figs. 168 – 171

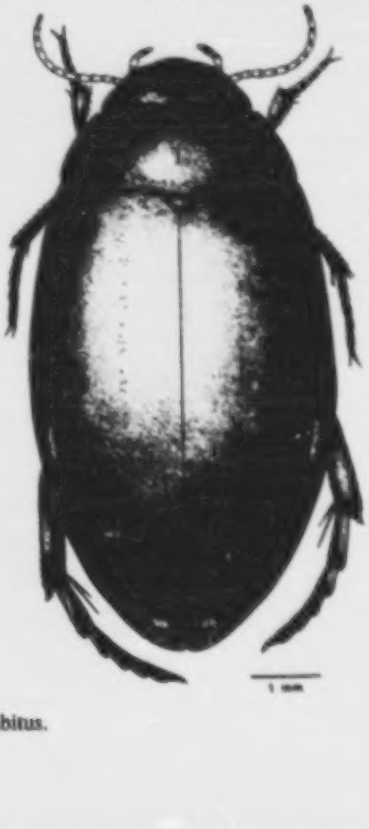


Fig. 168. *Ilybius angustior* habitus.

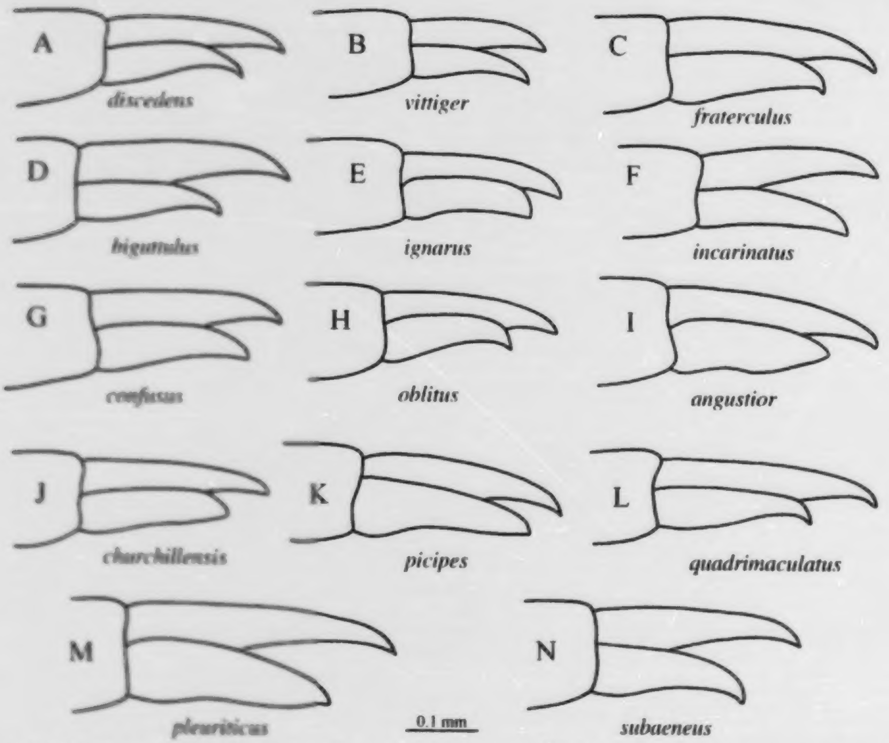


Fig. 169. *Ilybius*, male metatarsal claws, dorsal. A. - *I. discedens*. B - *I. vittiger*. C - *I. fraterculus*. D - *I. biguttulus*. E - *I. ignarus*. F - *I. incarinatus*. G - *I. confusus*. H - *I. oblitus*. I - *I. angustior*. J - *I. churchillensis*. K - *I. picipes*. L - *I. quadrimaculatus*. M - *I. pleuriticus*. N - *I. subaeneus*.

Ilybius Erichson, 1832: 18, 34. Type species *Dytiscus fenestratus* Fabricius, 1781: 294, designated by Westwood, 1838: 8.

Diagnosis. Moderate size, length = 7.1 to 11.1 mm. Body (Fig. 168) relatively strongly convex dorsally, widest posterad of middle, narrowed anteriorly and posteriorly. Color dark, mainly piceous to black with lateral margins variously paler; some specimens with a metallic reflection; elytron with a postmedial sublateral spot and a subapical spot. Sculpture dual, with coarse meshes of irregular shape, in turn bearing microreticulation.

Clypeus with anterolateral fovea separated medially. Eye emarginate above base of antenna. Pronotum with lateral bead. Prosternal process angulate to carinate in cross section, apex of various length pointed to acuminate; metasternum with anteromedial impression well developed, extending to level of hind margin of mesocoxal cavities or shorter. Metacoxal lines divergent anteriorly; metacoxal lobes rounded. Metafemur with a linear comb of setae on ventroapical angle; metatarsomeres 1 to 4 with external apical angles lobed; metatarsal claws (Fig. 169) unequal, dorsal claw shorter than ventral claw.

Male pro- and mesotarsomeres 1 to 3 narrowly dilated, bearing small scales beneath. Sternum 6 with hind margin entire, posteroventral surface smooth or with a longitudinal keel or ridges. Paramere of many species with sucker hairs on mesal face. Female sternum 6 emarginate posteromedially; gonocoxae strongly sclerotized, laterally flattened and toothed along apical dorsal margin.

Comments. This Holarctic genus contains about 30 species, of which 14 occur in the Nearctic region (Larson 1987). Five species are Holarctic.

These beetles are primarily lentic, occurring amongst dense emergent vegetation at the margins of generally permanent ponds, or at least in pools containing water over much of the summer. The saw-like ovipositor is used by the female to insert eggs into the tissue of aquatic plants (Jackson 1960). Eggs laid in the summer hatch into overwintering larvae which complete development and pupate the following spring. Emerging adults may lay eggs to complete a univoltine life cycle whereas others may overwinter to lay eggs the following summer giving a semivoltine life cycle. The univoltine life cycle predominates in the warm continental climate of Wisconsin (Hilsenhoff 1993c) whereas in northern Europe the semivoltine life cycle prevails (Nilsson 1986*a*). In the cool maritime climate of Newfoundland both types of life cycle occur although the univoltine pattern predominates (Hicks and Larson 1995). Adults that overwinter probably do so on land (Galewski 1966).

Key to species of *Ilybius* of North America

(from Larson 1987)

I. Pro- and mesotarsomeres 1 - 3 slightly broadened and bearing long-stalked, oval, yellow suckers beneath; sternum 6 with hind margin broadly rounded, truncate or slightly concave but not narrowly emarginate medially .... Key A, males

II. Pro- and mesotarsomeres lacking ventral suckers; sternum 6 with a narrow medial emargination or notch on hind margin ... Key B, females

Key A. Key to Males

1. Metatarsomeres 1 to 4 each with a ridge along dorsoexternal margin 2

1'. Metatarsomeres lacking ridge or bead 7

2(1). Sternum 6 with a number of coarse longitudinal rugae or striae on posterior surface, setiferous punctures more or less obscured by rugae; a narrow, longitudinal posteromedial keel present or not 3

2'. Sternum 6 more or less smooth or faintly rugose along posterior margin, setiferous punctures evident; a longitudinal posteromedial keel present .... 13. *I. pleuriticus* LeConte

3(2). Sternum 6 with a posteromedial keel; antenna with at least apical antennomere infuscate medially 4

3'. Sternum 6 lacking posteromedial keel but posterior surface with strong longitudinal rugae; antenna entirely yellow, without apical infuscation .... 14. *I. subaeneus* Erichson

4(3). Metatibia with coarse punctation restricted to basal one third to one half, remainder of ventral face finely punctate; aedeagus with apex spear-shaped in dorsal aspect .... 12. *I. quadrimaculatus* Aubé

4'. Metatibia with coarse punctation along length of ventral face: aedeagus evenly narrowed to apex 5

5(4). Size small, length = 7.1 to 8.6 mm; metasternal wing narrow, width of metacoxa: width metasternal wing = 2.4 to 3.6; body narrow, length: width = 1.89 to 2.07; aedeagus slender (Fig. 171F); body shiny black or some specimens distinctly aeneous; low arctic west of Hudson Bay ....10. *I. churchillensis* Wallis

5'. Larger, length = 7.5 to 10.2 mm; metasternal wing broad, width of metacoxa: width metasternal wing = 2.0 to 3.2; body broader, length: width = 1.82 to 2.03; aedeagus broader (Fig. 171A, G); body shiny to dull black, never aeneous; low arctic to boreal 6

6(5). Aedeagus tapering to a narrow, faintly reflexed apex (Fig. 171A); dorsal metatarsal claw with ventral margin sinuate and slightly expanded medially (Fig. 169I) ....9. *I. angustior* (Gyllenhal)

6'. Aedeagus with apex shorter and more bluntly rounded (Fig. 171G); dorsal metatarsal claw narrower, ventral margin not expanded medially (Fig. 169K) ....11. *I. picipes* (Kirby)

7(1). Sternum 6 with a posteromedial longitudinal keel 8

7'. Sternum 6 lacking a medial keel 9

8(7). Size small, length = 7.8 to 9.1 mm; body narrow, length: width = 1.89 to 2.07; metacoxal plate with strioles sparse and lightly impressed ....5. *I. ignarus* LeConte

8'. Larger, length = 8.9 to 11.5 mm; body broader, length: width = 1.77 to 1.95; metacoxal plate densely and conspicuously striolate ....4. *I. biguttulus* Germar

9(7). Metasternal wing narrow, width of metacoxa: width metasternal wing greater than 4.5 ....8. *I. oblitus* Sharp

9'. Metasternal wing broader, width of metacoxa: width metasternal wing less than 4.5 10

10(9). Sternum 6 with posteromedial area smooth and more or less flattened, laterally with coarse longitudinal or oblique rugae; elytron with many intersections of lines of sculpture each bearing a puncture; paramere lacking adhesive setae; boreal to low arctic 11

10'. Sternum 6 broadly rounded apically, lacking sublateral rugae; elytron lacking small punctures at intersections of lines of sculpture; paramere with or without adhesive setae; southern boreal and south 12

11(10). Sternum 6 with apex truncate or sinuate medially; aedeagus very large with apex reflexed (Fig. 170B); prosternal process normal, elongate; metasternal impression reaching level of hind margin of mesocoxae; boreal, transcontinental ....1. *I. discedens* Sharp

11'. Sternum 6 with apex broadly rounded; aedeagus shorter, apex not reflexed (Fig. 170D); prosternal process short, metasternal impression not reaching level of hind margin of mesocoxae; low arctic, west of Hudson Bay ....2. *I. vittiger* (Gyllenhal)

12(10). Metasternal wing broad, width of metacoxa: width metasternal wing less than 2.9; paramere lacking sucker setae on mesal face (Fig. 170E); aedeagus with a small apical hook Fig. 170F, G) . . . . .3. *fraterculus* LeConte

12'. Metasternal wing narrower, width of metacoxa: width metasternal wing greater than 2.8; paramere with sucker setae on mesal face (Fig. 170J, O); aedeagus with apex simple (Fig. 170K, P) 13

13(12). Length 8.7 to 10.0 mm; metasternal wings broad, width of metacoxa: width metasternal wing = 2.80 to 3.45 . . . .6. *I. incarinatus* Zimmermann

13'. Length 9.7 to 11.0 mm; metasternal wings narrower, width of metacoxa: width metasternal wing = 3.40 to 4.10 . . .7. *I. confusus* Aubé

Key B. Key to Females

1. Metatibia with posterior margin and metatarsomeres 1 to 3 with outer margins bearing long, brown natatorial setae . . . . .1. *I. discedens* Sharp

1'. Metatibia and metatarsomeres lacking such setae 2

2(1). Elytron with intersections of lines of sculpture each with a small puncture; prosternal process short, metasternum with anteromedial impression small and not extending posteriorly to level of hind margin of mesocoxae; low arctic, west of Hudson Bay . . . . 2. *I. vittiger* (Gyllenhal)

2'. Elytron without evident punctures at intersections of lines of sculpture; prosternal process various but most specimens with metasternal impression extending posteriorly to level of hind margin of mesocoxal cavities 3

3(2). Antenna with at least apical antennomere infuscate medially (many specimens with infuscation more expanded on antenna and labial palpus) 4

3'. Antenna and palpi entirely yellow or pale reddish and devoid of infuscation 7

4(3). Metatibia with ventral face finely and sparsely punctate on distal half to two-thirds, more coarsely punctate at base; size larger, length = 9.4 to 11.1 mm; western . . . . .12. *I. quadrimaculatus* Aubé

4'. Metatibia with coarse punctures along length of ventral face (size and density of punctures may decrease distally on some specimens); smaller, length = 7.1 to 10.2 mm; boreal to low arctic 5

5(4). Size smaller, length = 7.1 to 8.6 mm; metasternal wing narrow, width of metacoxa: width metasternal wing = 2.[illegible]0 to 3.30; body narrow, length: width = 1.89 to 2.07; body shiny black or some specimens distinctly aeneous; low arctic west of Hudson Bay . . . . 10. *churchillensis* Wallis

5'. Larger, length = 7.5 to 10.2 mm; metasternal wing broader, width of metacoxa: width metasternal wing = 2.00 to 3.20; body broader, length: width = 1.82 to 2.03; body shiny to dull black, at most faintly aeneous; low arctic to boreal 6

6(5). Gonocoxa, in lateral aspect, with dorsal margin almost straight or only broadly and evenly concave proximad of distal teeth . . . . 11. *I. picipes* (Kirby)

6'. Gonocoxa with dorsal margin strongly sinuate or emarginate subbasally . . . . 9. *I. angustior* (Gyllenhal)

7(3). Metatibia with coarse punctures along length of ventral face (size and density of punctures may decrease distally on some specimens) 8

7'. Metatibia with apical half to two-thirds of ventral face only finely and sparsely punctate 9

8(7). Sternum 6 with marginal bead obsolete on outer angle of medial emargination; elytron with meshes of primary sculpture relatively large and irregular in shape with some fusion of adjacent meshes; length = 10.6 to 12.6 mm . . . . .13. *I. pleuriticus* LeConte

8'. Sternum 6 with marginal bead continuous around lateral angle of medial emargination; elytron with primary meshes of sculpture smaller and more regular in size and shape; most specimens with dorsal surface distinctly aeneous; length = 9.1 to 11.0 mm . . . . .14. *I. subaeneus* Erichson

9(7). Metasternal wing narrow, width of metacoxa: width metasternal wing greater than 4.5 . . . . .8. *I. oblitus* Sharp

9'. Metasternal wing broader, width of metacoxa: width metasternal wing less than 4.5 10

10(9). Small, length = 7.8 to 9.1 mm; elongate, length: width = 1.89 to 2.07;metacoxal plate with strioles separate, sparse and lightly impressed; color black with lateral margins piceous or at most narrowly reddish; elytron basomedially with meshes of sculpture small, irregular and not or only slightly longitudinally stretched . . . . .5. *I. ignarus* (LeConte)

10'. Larger, length = 8.4 mm or greater; body broader, length: width = 1.73 to 1.98; metacoxal plate with strioles well developed and intersecting; color various; elytral sculpture various 11

11(10). Sternum 6 with posteromedial emargination deep; metasternal wings broad, width of metacoxa: width metasternal wing = 2.3 to 3.0; elytron basomedially with at least some meshes strongly longitudinally stretched; elytron of most specimens with subapical spot absent or faintly developed; transcontinental but only common on Great Plains and west . . . . .3. *I. fraterculus* LeConte

11'. Sternum 6 with medial emargination shallower; metasternal wing broader, width of metacoxa: width metasternal wing = 2.55 to 4.10, but if less than 2.80, meshes of elytral sculpture not or only slightly stretched (no meshes more than three times as long as wide); elytron of most specimens with subapical spot distinct; Rocky Mountains and east but only common east of Great Plains 12

12(11). Elytron with meshes of primary sculpture more rounded, few or no meshes more than three times as long as wide . . . .4. *I. biguttulus* Germar

12'. Elytron basosuturally with many meshes strongly elongated and more than three times as long as wide 13

13(12). Length = 8.7 to 10.0 mm; width of metacoxa: width metasternal wing = 2.80 to 3.40 ....6. *I. incarinatus* Zimmermann

13'. Length = 9.7 to 11.0 mm; width of metacoxa: width metasternal wing = 3.30 to 4.10 ....7. *I. confusus* Aubé

1. *Ilybius discedens* Sharp 1882

Figs. 169A; 170A, B

Ilybius discedens Sharp 1882*a*: 557. Type locality - "Hudsons Bay".

Selected References. Larson 1987*b*: 350 – 362; Hilsenhoff 1993*c*: 194; Larson 1997*b*: 511.

Description. Length = 7.10 to 9.03 mm; width = 3.6 to 4.8 mm; length: width = 1.80 to 2.00. A moderately small species.

Color mainly black without metallic sheen. Head with frontal spots, labrum and anterior margin of clypeus rufous; palpi entirely rufous; antenna yellow except apical antennomere darkened medially and apically. Lateral margins of pronotum and elytron at most faintly piceous; elytron with sublateral and subapical pale spots evident on most specimens. Legs dark rufous to piceous.

Elytron with small irregular meshes which bear fine microreticulation (may be somewhat effaced basomedially); small punctures present at intersections of lines and a few scattered punctures also present on some meshes.

Prosternum and prosternal process with ventral margin concave medially between procoxae in lateral aspect, medial convexity of prosternum somewhat swollen or inflated anteriorly; prosternal process strongly tectiform and not explanate basally, basal bead of more or less uniform width behind procoxae; apex acuminate apically but short. Metasternal impression attaining level of hind margin of mesocoxal cavities. Metasternal wings relatively narrow, width of metacoxa: width metasternal wing = 2.85 to 4.11. Metacoxal plate with strioles shallow, sparse and more or less separated; shallow punctures present but somewhat obscured by microreticulation. Metacoxal lines strong, slightly sinuate anteriorly, traceable to metasternum. Metafemur with ventral face finely punctate, strioles absent. Metatibia with a few coarse punctures basally on ventral face, otherwise impunctate or with only a few very fine punctures. Longer metatibial spur subequal in length to metatarsomere 1. Metatarsomere 1 lacking ventrolateral setae.

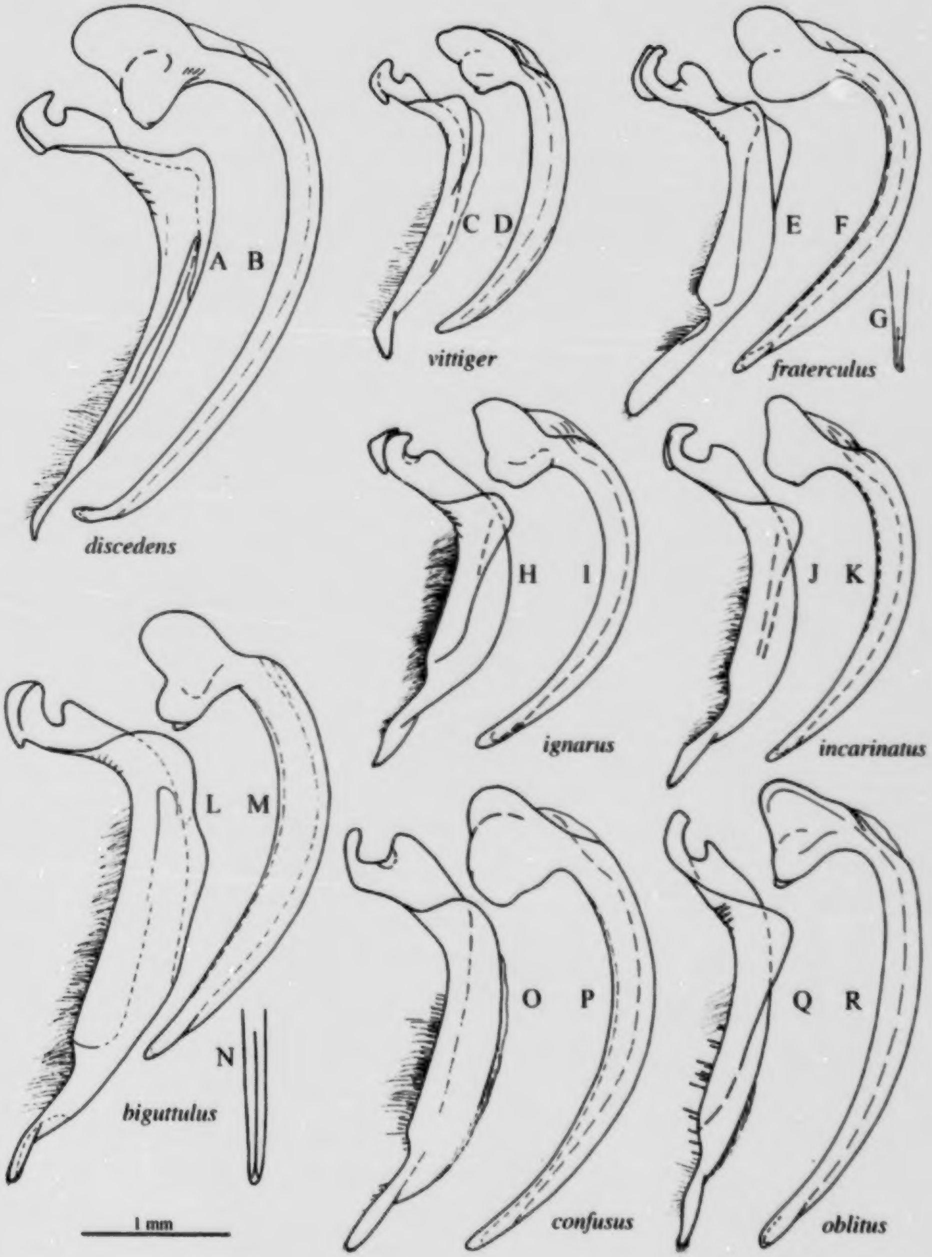

A
B
discedens
C
D
vittiger
E
F
G
fraterculus
H
I
ignarus
J
K
incarinatus
L
M
N
biguttulus
O
P
confusus
Q
R
oblitus
1 mm

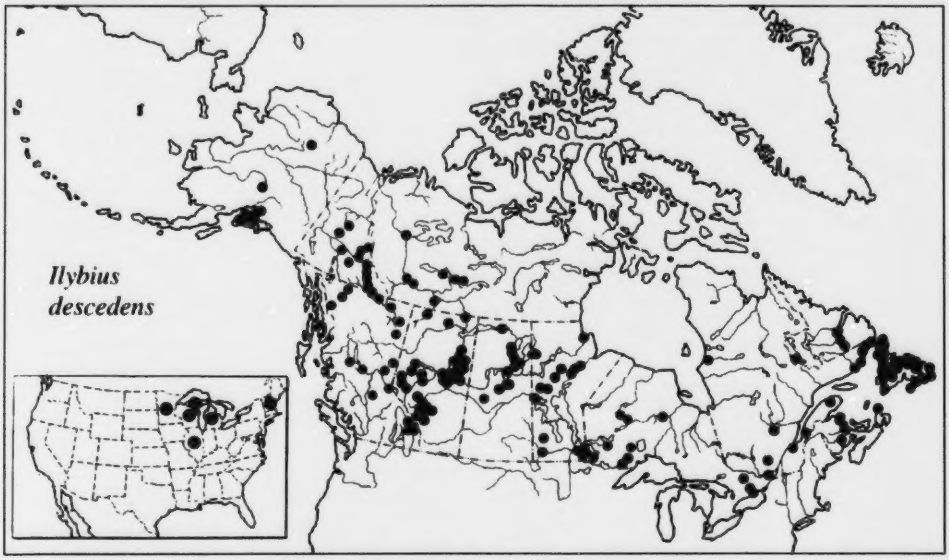
Fig. 170. *Ilybius*, male genitalia. A, B - *I. discedens*. A - paramere. B - aedeagus, lateral. C, D - *I. vittiger*. C - paramere. D - aedeagus, lateral. E - G - *I. fraterculus*. E - paramere. F - aedeagus, lateral. G - aedeagus apex, dorsal. H, I - *I. ignarus*. H - paramere. I - aedeagus, lateral. J, K - *I. incarinatus*. J - paramere. K - aedeagus, lateral. L - N - *I. biguttulus*. L - paramere. M - aedeagus, lateral. N - aedeagus apex, dorsal. O, P - *I. confusus*. O - paramere. P - aedeagus, lateral. Q, R - *I. oblitus*. Q - paramere. R - aedeagus, lateral.

Male protarsal claws slender, especially posterior claw which is abruptly narrowed about middle. Metacoxae with posteromedial keel absent or at most weakly developed. Metatarsomeres lacking a dorsolateral ridge or bead. Metatarsal claws (Fig. 169A) with dorsal claw smoothly arcuate. Sternum 6 with apex broadly truncate or shallowly bisinuate; flat and smooth posteromedially and longitudinally striate laterally, lateral bead absent across medial flattened area. Subgenital plate truncate apically, striate laterally but largely smooth medially; lateral sclerites longitudinally strigate. Paramere (Fig. 170A) slender, setose on mesal margin but lacking sucker setae; aedeagus (Fig. 170B) very elongate, longer than paramere, apex broadened and reflexed ventrally.

Female with microreticulation of elytron more strongly developed than on male, elytra of most specimens slightly duller than those of male. Metatibia with mesal margin and metatarsomeres along outer margin bearing elongate brown natatorial setae. Sternum 6 with lateral angles of apical emargination broadly rounded and semicircular, emargination compressed in posterior aspect, medially sternum raised into a low crest in lateral aspect with ventroapical margin right angled or produced as a small spine.

Ecology. This is one of the most characteristic water beetle species of boreal peatlands (Larson 1985). The beetles occur in small, moss-ringed pools, often where the water is cold to the touch. In Newfoundland, most individuals have a univoltine life cycle with overwintering occurring in instar III and teneral beetles are found primarily in July and August. However, some adults overwinter and may lay eggs in two summers (Hicks and Larson 1995). There are no records of flight.

Distribution. Map 216. *Ilybius discedens* has a wide distribution in the northern boreal portion of the Nearctic region and extends into the eastern Palaearctic region. The Nearctic range extends from Newfoundland to western Alaska and from the northern limit of trees south into the northeastern United States.



Map 216. *Ilybius discedens* Sharp. Canadian and Alaskan collection localities and United States state records.

2. *Ilybius vittiger* (Gyllenhal 1827)
Figs. 169B; 170C, D

Dytiscus vittiger Gyllenhal 1827: 379. Type locality - "Lapponiae borealis".

Selected References. Larson and Roughley 1983: 7 – 15; Nilsson 1983*c*: 49 – 86; Larson 1987*b*: 262 – 364; Nilsson and Holmen 1995: 123; Larson 1997*b*: 512.

Description. Length = 6.8 to 7.9 mm (8.5 mm in northern Europe); width = 3.9 to 4.1 mm; length: width = 1.75 to 1.93. Size small; body relatively depressed and broadly oval in outline, resembling a member of the genus *Agabus*.

Color of body piceous to black dorsomedially, without or with only a faint metallic reflection. Head with labrum, anterior margin of clypeus and frontal spots, rufous to piceous; antenna rufous or some specimens with apical antennomere faintly infuscate. Palpi rufous. Pronotum narrowly piceous laterally. Elytron with lateral margin, or on some specimens entire disc, piceous. Legs rufous to rufopiceous.

Elytron with primary meshes of sculpture large, of very irregular shape and without distinct longitudinal stretching. Intersections of lines with small punctures, also small punctures located in many meshes. Microreticulation present but on many specimens effaced basally.

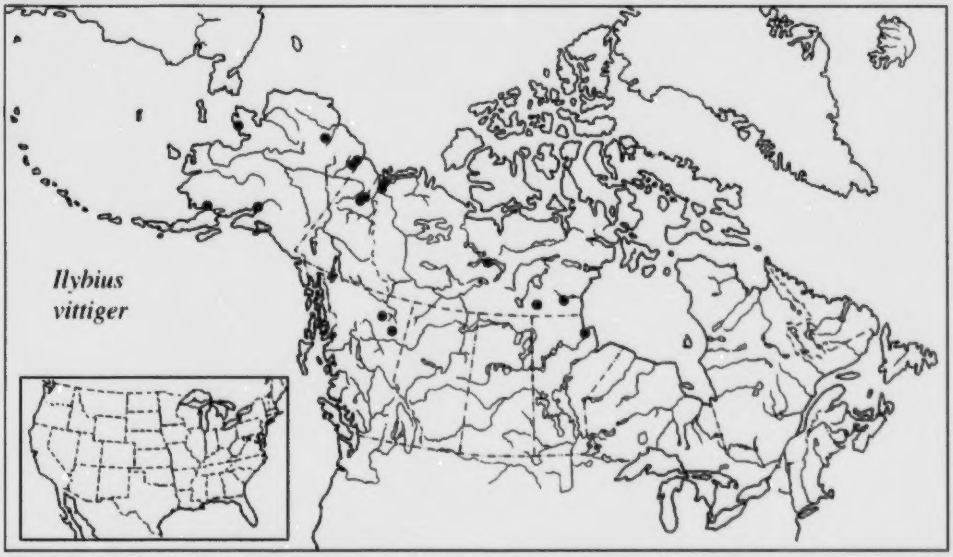
Prosternal process relatively short, tectiform; lateral bead not inflated behind procoxae. Metasternal impression short, its apex not attaining level of hind margin of mesocoxal cavities. Metasternal wings moderately narrow, width of metacoxa: width metasternal wing = 2.75 to 3.67. Metacoxal plate with strioles lacking or weakly developed; its surface microreticulate and with poorly defined transverse rugae. Metacoxal lines traceable to metasternum. Hind legs relatively narrow. Metafemur with small punctures but lacking strioles. Metatibia with irregular coarse punctures on ventrolateral face, these punctures distributed along entire length of tibia or on many specimens becoming smaller or disappearing on distal third to half. Metatibial spurs subequal in length to metatarsomere 1. Metatarsomere 1 with one or more coarse setae along ventrolateral margin of most specimens. Metatarsal claws with only a slight disparity in size; dorsal claw shorter and with apex more arcuate than ventral claw.

Male protarsomeres 1 to 3 only slightly broadened, with a very small group of golden setae on ventroapical portion of each; protarsal claws slender, anterior and posterior each slightly sinuate ventrally. Metacoxae with a very small longitudinal keel along posterior portion of medial line. Metatarsomeres 1 to 3 lacking a dorsolateral bead; dorsal metatarsal claw (Fig. 169B) slender and evenly curved. Sternum 6 with apex broadly rounded or slightly emarginate medially; ventral surface smooth medially with lateral longitudinal rugae; lateral bead absent or only weakly defined across apex. Subgenital plate broad and slightly emarginate apically, it and lateral plates longitudinally rugose. Paramere (Fig. 170C) slender, lacking adhesive setae along mesal face. Aedeagus (Fig. 170D) subequal in length to paramere, simple in form with apex narrowly rounded.

Female metatibia along mesal margin and metatarsomeres along outer margin lacking natatorial setae. Sternum 6 with a narrow medioapical emargination; medially with a prominent rounded ventral knob; laterally to knob with a few scattered coarse setiferous punctures, smaller micropunctures and, on most specimens, an area of prominent transverse or oblique microrugae; lateral bead complete along hind margin of sternum except where narrowly broken on crest of knob.

Ecology. The species occurs in northern boreal and low arctic regions where it inhabits small bog pools with sparse vegetation as well as patches of emergent vegetation in quiet sections of boggy streams. In northern Europe it occurs in pools in wet spruce forests as well as in bog margins (Nilsson and Holmen 1995). Nilsson (1983) reported that this is an autumn-breeder with overwintering larvae. There are no North American records of flight.

Distribution. Map 217. This species is Holarctic in distribution, occurring across the northern boreal and low arctic portion of the Palaearctic region and in western North America east to the eastern Northwest Territories and northern Manitoba and south to northern British Columbia.



Map 217. *Ilybius vittiger* (Gyllenhal). Canadian and Alaskan collection localities and United States state records.

3. *Ilybius fraterculus* LeConte 1862

Figs. 169C; 170E – G

Ilybius fraterculus LeConte 1862: 521. Type locality - North Red River.

Selected References. Larson 1987*b*: 364 – 367; Hilsenhoff 1993*c*: 194.

Description. Length = 9.3 to 10.7 mm; width = 5.1 to 6.0 mm; length: width = 1.74 to 2.01. Size moderate, body moderately elongate.

Dorsal surface piceous to black, with a faint cupreous sheen on some specimens. Head with frontal spots, anterior margin of clypeus and labrum, rufous; antenna and palpi entirely yellow. Lateral margins of pronotum and elytra broadly reddish; elytron of most specimens with subapical spot absent or obscure; epipleuron rufous. Ventral surface and legs, rufous to piceous.

Pronotum with sculpture consisting of irregular, somewhat rounded meshes over most of disc, however mediolaterally and sublaterally some meshes are elongated and subparallel. Elytron with lines deep, meshes relatively coarse; basally and along suture many meshes narrow and longitudinally stretched with many meshes 3 or more times as long as broad; laterally and apically meshes more rounded in outline and without a definite pattern of orientation; meshes with secondary sculpture obsolete over most of disc and coherent only at extreme apex. Intersections of lines lacking punctures.

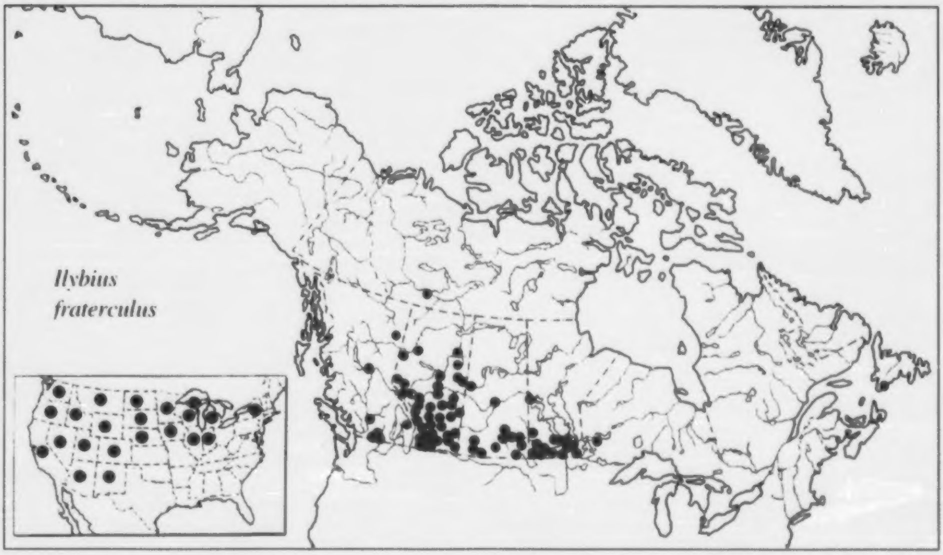
Prosternal process elongate, acute apically; lateral bead of moderate width behind procoxae and not evidently inflated, in ventral aspect apex of process more or less evenly narrowed apically from level of termination of lateral bead; in lateral aspect ventral surface of process more or less straight. Metasternum with anteromedial impression extending posteriorly to level of hind margin of mesocoxae. Metasternal wings broad, width of metacoxa: width metasternal wing = 2.32 to 2.97. Metacoxal plate with reticulation distinct but fine, subshiny; strioles deep but short, little sinuate and for the most part separate. Metafemur finely but distinctly punctate, punctures rounded or a few slightly elongate and forming fine strioles. Metafemur with coarse punctation of ventral face restricted to basal third, distal two thirds sparsely and finely punctate. Metatarsomere 1 lacking ventrolateral setae.

Male posterior protarsal claw slightly shorter and narrower than anterior, sinuate ventrally with a shallow ventral basal emargination. Metatarsus with dorsal claw arcuate apically (Fig. 169C). Sternum 6 unmodified, lacking rugae and median keel, lateral bead obsolete or faintly traceable medially. Subgenital plate broad apically, subtruncate or shallowly emarginate apically; it and lateral sclerites strigate. Paramere (Fig. 170E) with inner face lacking sucker hairs but with patches of stiff setae near medial shoulder and at base of apical piece; inner basal face broadly sclerotized, lateral face with sclerotized area narrow, shoulder very prominent. Aedeagus (Fig. 170F, G) with apex bent in a short but distinct hook.

Female metatibia and lateral margin of metatarsomeres lacking natatorial setae. Sternum 6 with a deep V-shaped posteromedial emargination; sides of emargination little pinched, lateral angles obtuse but prominent and relatively narrowly rounded, completely margined.

Ecology. This species occurs primarily in grassland ponds, usually where the water is sun- warmed but where emergent vegetation is abundant. Larson (1985) noted that of the western species of *Ilybius* this is the most adapted to warm, temporary ponds. Gordon and Post (1965) found this species to be attracted to ultraviolet light in large numbers in North Dakota.

Distribution. Map 218. Collection records extend across the continent at mid latitudes, but the species is common only from the western Great Lakes area and west.



Map 218. *Ilybius fraterculus* (LeConte). Canadian and Alaskan collection localities and United States state records.

4. *Ilybius biguttulus* (Germar 1824)

Figs. 169D; 170L – N

Dytiscus biguttulus Germar 1824: 29. Type locality: North America.

Selected References. Michael and Matta 1977: 36 – 37; Larson 1987*b*: 367 – 371; Hilsenhoff 1993*c*: 193.

Description. Length = 8.8 to 10.5 mm; width = 4.6 to 6.0 mm; length: width = 1.77 to 1.98. Size moderate, body relatively broadly oval.

Color dorsally piceous to black except anterior margin of head, frontal spots and lateral margins of pronotum and elytra reddish to piceous; antenna and palpi yellow to light red, without apical infuscation; legs and epipleuron reddish.

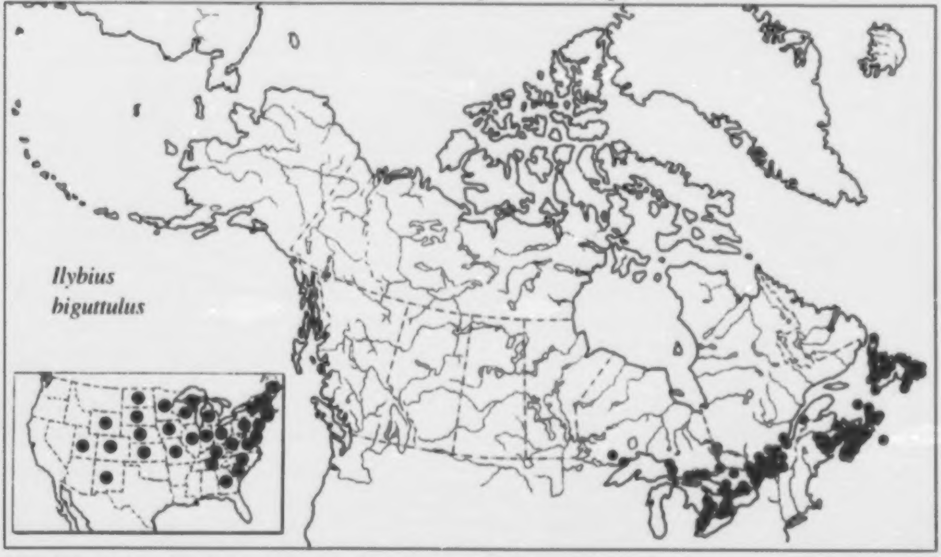
Elytron with meshes of sculpture of small to moderate size and irregular shape, some males and most females with meshes on basosutural portion of disc somewhat longitudinally stretched but generally length of longest meshes not more than three times their width (some specimens with a few meshes four or five times as long as wide); microreticulation effaced or faint basally, evident on apical third to half. Intersections of lines not punctate.

Prosternal process elongate, narrow and acuminate apically; process with lateral bead relatively broad between and behind procoxae; in ventral aspect apex of process abruptly narrowed at level of termination of broadened portion of lateral bead; process in lateral aspect with ventral margin more or less straight or slightly convex. Metasternal impression extending beyond level of hind margin of mesocoxal cavities. Metasternal wings broad, width of metacoxa: width metasternal wing = 2.55 to 3.32. Metacoxal plates with strioles well impressed, dense, elongate and with various degrees of interconnection; transverse rugae shallow but evident. Metacoxal lines evenly diverging anteriorly, not attaining metasternal suture. Metafemur very finely punctate, without elongated punctures or strioles. Metatibia with ventral surface finely and sparsely punctate medially except for coarse punctures on basal third and along hind margin; longer metatibial spur slightly longer than metatarsomere 1. Metatarsomere 1 lacking mediodorsal and ventrolateral setae.

Male posterior protarsal claw slightly shorter, narrower and more strongly sinuate ventrally than anterior: both claws with a ventrobasal impression, best developed on posterior claw. Metacoxae with a small longitudinal keel on posterior region of medial line. Metatarsomeres lacking externodorsal bead; dorsal metatarsal claw (Fig. 169D) tapered and shortly arcuate at apex. Sternum 6 smooth or with a few shallow longitudinal rugae along posterior margin, setiferous punctures evident; a short but distinct posteromedial longitudinal keel present; lateral bead of sternum obsolete medially near keel. Subgenital plate broad apically with a shallow medial emargination, it and lateral plates with coarse longitudinal striae. Paramere (Fig. 170L) bearing sucker hairs on ventral face. Aedeagus (Fig. 170M, N) simple, subequal in length to paramere.

Female metatibia with inner margin and metatarsomeres with outer margin lacking natatorial setae. Sternum 6 with posteromedial emargination of moderate size, lateral angles broadly obtuse and rounded, lateral bead disappearing on angle and internally replaced by a dense marginal array of small punctures; in posterior aspect sides of emargination not or only slightly pinched and middle only slightly raised as a knob.

Ecology. This species occurs primarily in permanent lentic habitats, where the water is usually sun-warmed and the vegetation is dense although Hilsenhoff (1993*c*) also collected larvae from stream margins. In Newfoundland, where the *Ilybius* fauna is rich (seven species known), this species is found in the warmest, most nutrient-rich habitats occupied by any of the species. Many records of flight have been seen, between May 30 and July 26, as well as single records for Aug. 20 and Sept. 1.



Map 219. ***Ilybius biguttulus*** **(Germar). Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 219. *Ilybius biguttulus* has a wide distribution in eastern North America, from the southern boreal zone of Newfoundland and Quebec, south to northern Georgia. It is also found in the Rocky Mountain states, from Wyoming to New Mexico and Utah, as well as sparingly across the south-central Great Plains.

5. *Ilybius ignarus* (LeConte 1862)

Figs. 169E; 170H, I

Colymbetes ignarus LeConte 1862: 521.

Selected Reference. Larson 1987*b*: 371 – 372; Hilsenhoff 1993*c*: 194 – 195.

Description. Length = 7.8 to 9.1 mm; width = 4.1 to 4.7 mm; length: width = 1.89 to 2.07. Small, elongate.

Color of body black dorsally except frontal spots, anterior margin of clypeus and lateral margins of pronotum and elytron dark rufous to piceous; antenna and palpi entirely pale, without infuscation; venter mainly black with epipleuron and legs dark reddish.

Elytron with sculpture consisting of small meshes of irregular size and shape which either show no tendency of longitudinal stretching, or basosuturally a few meshes slightly elongated; microreticulation obsolete basally but evident apically; intersections of lines without punctures.

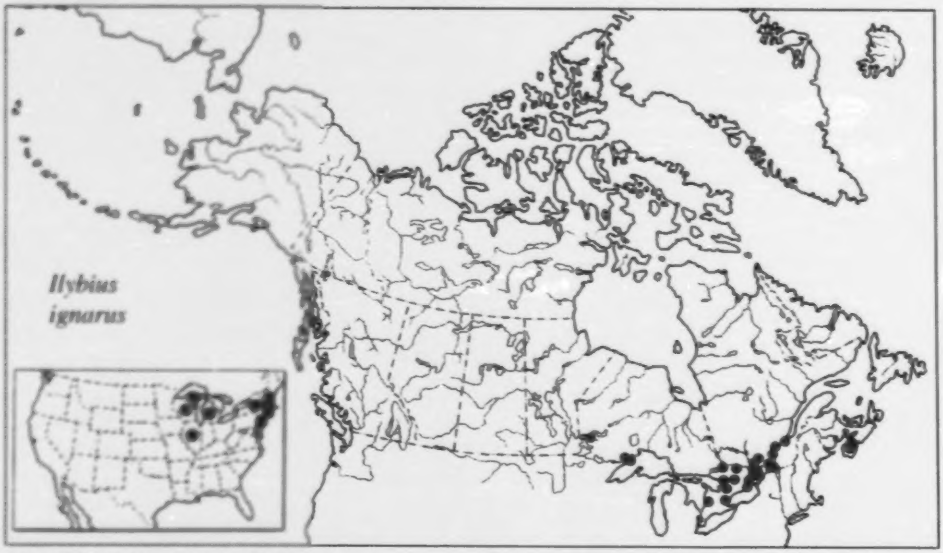
Prosternal process elongate, apically acuminate; lateral bead broadened between procoxae; in ventral aspect process evidently constricted at level of termination of thickened portion of lateral bead then more or less evenly narrowed towards apex. Metasternal impression well developed and extending posteriorly to level of hind margin of mesocoxal cavities. Metasternal wings somewhat narrower than in *I. biguttulus*, width of metacoxa: width metasternal wing = 2.85 to 3.24. Metacoxal plates with microreticulation relatively lightly impressed, surface shiny; strioles sparse, shallow, short and more or less isolated; sparse punctation distinct. Metacoxal lines not reaching metasternal suture. Metafemur with ventral face finely punctate, nonstrigate. Metatibia with ventral face finely and sparsely punctate except for coarse punctures at base and along hind margin. Longer metatibial spur slightly longer than metatarsomere 1. Metatarsomere 1 lacking dorsal and ventral coarse spines.

Male anterior and posterior protarsal claws similar in shape, shallowly but evidently sinuate ventrally, the posterior claw most distinctly so. Metacoxae with a small longitudinal keel on posterior portion of medial line. Metatarsomeres lacking bead on outer dorsal margin; dorsal metatarsal claw slender, its apex narrowly rounded (Fig. 169E). Sternum 6 with posterior margin smooth or faintly rugose, setiferous punctures evident; with a low medial longitudinal keel which on most specimens is at least faintly traceable along midline of posterior half of sternite; lateral bead well developed and continuous along hind margin to medial keel. Subgenital plate with apex broad and shallowly emarginate, it and lateral plates coarsely strigate. Paramere (Fig. 170H) bearing sucker hairs of irregular length along inner face. Aedeagus (Fig. 170I) simple.

Female metatibia with inner margin and metatarsomeres along outer margin lacking natatorial setae. Sternum 6 with apical emargination shallow, lateral margins of emargination appearing pinched in posterior aspect so that sternum at middle is produced as a short knob or ridge; lateral bead complete around lateral angles of emargination.

Ecology. This species occurs primarily in peatland pools and permanent marshes. Specimens have been collected at light between June 29 and July 25, and September 14.

Distribution. Map 220. The distribution is rather limited, with collection records primarily in the northern Appalachian region and adjacent boreal areas, west to Wisconsin.



Map 220. *Ilybius ignarus* (LeConte). Canadian and Alaskan collection localities and United States state records.

6. *Ilybius incarinatus* Zimmermann 1928

Figs. 169F; 170J, K

Ilybius incarinatus Zimmerman 1928: 181–182. Type locality - Glauco, Illinois.

Selected References. Larson 1987*b*: 373 – 376; Hilsenhoff 1993*c*: 195.

Description. Length = 8.7 to 9.9 mm; width = 4.8 to 5.7 mm; length: width = 1.74 to 1.86. Size moderate, body relatively broad.

Head red, palest anteriorly and darkened between eyes and along posterior margin; antenna and palpi entirely pale. Pronotum piceous medially, lateral margins broadly reddish. Elytra piceous to black medially, lateral margins lateral of submedial spot, reddish, disc either gradually darkened mesad or some specimens with transition to dark color of disc relatively abrupt; epipleuron red. Ventral surface and legs red to piceous.

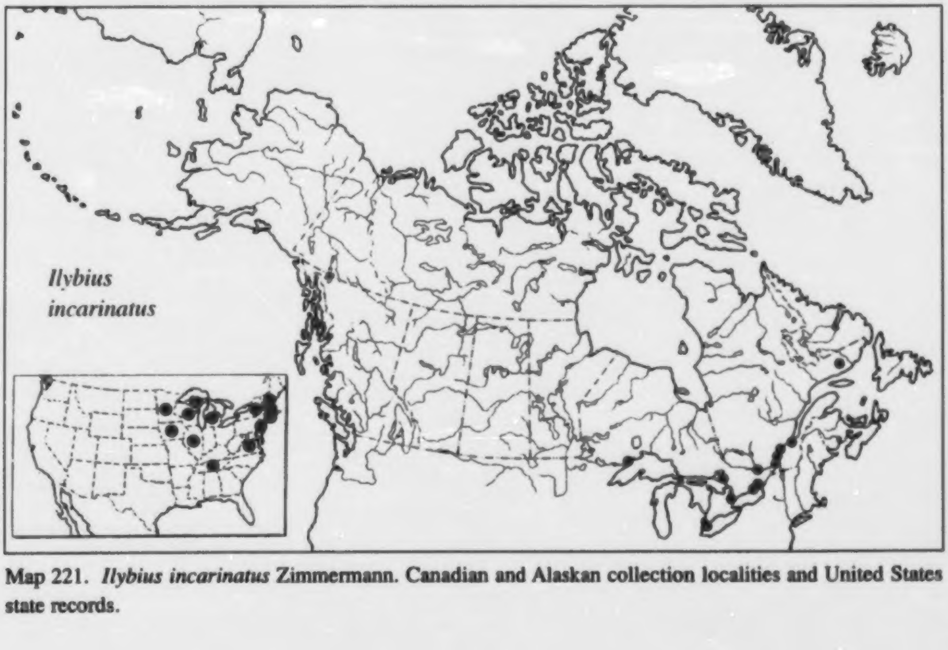
Elytron basosuturally with many narrow, elongate, parallel meshes interspersed with shorter smaller meshes, many meshes five or more times as long as wide; laterally and posteriorly meshes less evidently stretched and more rounded or irregular in shape. Meshes smaller and more regular than in *I. confusus*, with fewer laterally confluent meshes.

Prosternal process elongate and acuminate; marginal bead somewhat inflated between procoxae; in ventral aspect apex relatively abruptly constricted distad of broadened portion of lateral bead; in lateral aspect apical portion deflected dorsad and somewhat out of plane of basal portion of process, or some specimens with ventral margin broadly arched. Metasternum with anteromedial impression reaching level of hind margin of mesocoxal cavities. Metasternal wings moderately broad, width of metacoxa: width metasternal wing = 2.7 to 3.5. Metacoxal plates with strioles fine, elongate, somewhat sinuate and variously branched or interconnected, especially posteriorly; strioles longer and better developed than on *I. confusus*. Metacoxal lines not attaining metasternal suture. Metafemur finely punctate, with a few very fine strioles present posteromedially. Metatibia with ventral face finely punctate except for coarse punctures at base and along hind margin. Longer metatibial spur longer than metatarsomere 1. Metatarsomere 1 lacking dorsal and ventral longitudinal spines.

Male protarsal claws similar in shape but posterior claw slightly shorter than anterior, ventrally each claw slightly sinuate and emarginate basally. Metacoxae with a small keel on posterior portion of medial line. Metatarsomeres lacking dorsoexternal bead. Dorsal metatarsal claw narrow, subparallel and broadly rounded to ventroapical point (Fig. 169F). Sternum 6 unmodified, broadly rounded or slightly truncate apically, completely margined laterally; surface lacking rugae and posteromedial keel. Subgenital plate broad apically, it and lateral plates strigate. Paramere and aedeagus (Fig. 170J, K) similar to that of *I. biguttulus*.

Female metatibia with internal margin and metatarsomeres with outer margin lacking natatorial setae. Sternum 6 with apical emargination shallow, in posterior aspect sides slightly compressed with middle produced as a short rounded knob; marginal bead complete except at crest of medial knob.

Ecology. Several specimens were collected in Nova Scotia from among emergent sedges in a shallow, open pond in an abandoned quarry. The pond appeared to be permanent for large, overwintered tadpoles were abundant at the time of collection (late May). The



Map 221. ***Ilybius incarinatus*** **Zimmermann. Canadian and Alaskan collection localities and United States state records.**

bottom of the pond had a shallow layer of organic silt and the margins had a narrow shelf of sphagnum behind which were deciduous trees. Hilsenhoff (1993) found specimens in a large *Typha* marsh. Specimens have been collected at light from June 12 to 23 in Massachusetts, Quebec and Washington, D.C.

Distribution. Map 221. This species occurs in the region around the Great Lakes, east to Nova Scotia and south to Washington, D. C., and Tennessee.

7. *Ilybius confusus* Aubé 1838

Figs. 169G; 170O, P

Ilybius confusus Aubé 1838*b*: 280. Type locality - United States.

Selected References. Larson 1987: 376 – 379; Hilsenhoff 1993: 193.

Description. Length = 9.9 to 11.0 mm; width = 5.2 to 6.1 mm; length: width = 1.73 to 1.86. Moderately large, broad.

Color various, body rufous to piceous dorsally with lateral margins broadly paler reddish; red lateral margins gradually darkened mesad on disc or some specimens with body laterad of sublateral elytral vittae abruptly paler; elytron with subapical vitta present as a small triangular or crescentic spot, sublateral vitta various in size ranging from a small oval spot subequal in size to subapical vitta to a long line about half length of elytron. Antenna and palpi pale, without infuscation. Ventral surface and legs red to piceous.

Elytron with sculpture various, basosuturally most specimens with some meshes of primary sculpture longitudinally stretched and with a few meshes five or more times as long as wide; meshes coarser than in *I. incarinatus*, not so regular in form with more lateral fusion of adjacent meshes to give many meshes of very irregular shape on basosutural portion of disc (a few specimens have been seen in which the sculpture is similar to that of *I. biguttulus* with meshes small, rounded and not especially stretched or laterally fused).

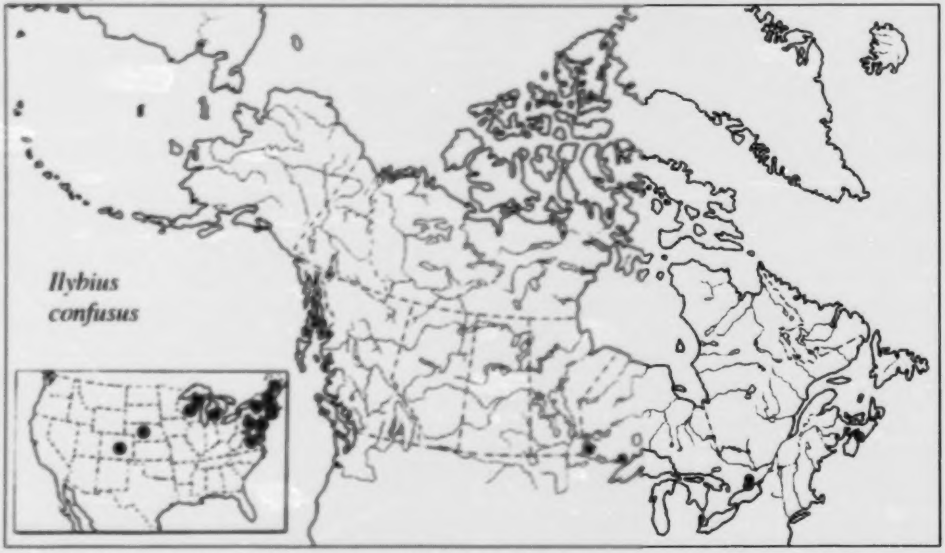
Prosternal process elongate and acuminate apically; lateral bead evidently broadened between procoxae; in ventral aspect apex more or less evenly tapered distally from level of termination of broadened portion of lateral bead, apex more evenly narrowed than in *I. incarinatus*; in lateral aspect, ventral margin straight or only slightly convex. Metasternal impression extended posteriorly to level of hind margin of mesocoxal cavities. Metasternal wing narrow, width of metacoxa: width metasternal wing = 3.3 to 4.1. Metacoxal plate with dense subparallel strioles but strioles short and more or less separate. Metacoxal lines not reaching metasternal suture. Metafemur finely and sparsely punctate, without or with only very faint strioles near posterior margin. Metatibia with ventral face finely punctate medially and distally or with a sparse row of slightly larger punctures along mid longitudinal region; coarser punctures present at base and parallelling inner margin. Longer metatibial spur longer than metatarsomere 1. Metatarsomere 1 lacking ventrolateral coarse setae.

Male protarsal claws each with a small ventrobasal emargination. Medial metacoxal line with a faint keel near posterior end. Metatarsomeres lacking dorsolateral bead. Metatarsal claws (Fig. 169G) with dorsal claw slightly arcuate, narrowing gradually towards apex. Sternum 6 with apex more or less truncate, marginal bead complete; ventral surface smooth and without longitudinal rugae or posteromedial keel. Subgenital plate with apex broad, emarginate medially, it and lateral plates longitudinally strigate. Paramere and aedeagus (Fig. 170O, P) similar to that of *I. biguttulus*, sucker hairs present on medial face of paramere.

Female metatibia along internal margin and metatarsomeres externally lacking natatorial setae. Sternum 6 shallowly emarginate apically, lateral angles of emargination very broadly rounded and with a complete marginal bead; in posterior aspect sides of emargination compressed and middle of emargination acutely produced.

Ecology. Wallis (1933) reported the species (as *I. denikei*) from along the shore of Long Pine Lake near Ingolf, Ontario. The beetles occurred among plant debris in shallow water along a sandy lake shore near where a small stream entered the lake from a swamp. Hilsenhoff (1993) collected a few specimens from permanent ponds. We have seen a record for flight on July 7.

Distribution. Map 222. The range extends along the Atlantic coast from Nova Scotia to Washington, D. C., and westward to western Ontario, Nebraska, and Colorado.



Map 222. *Ilybius confusus* Aubé. Canadian and Alaskan collection localities and United States state records.

8. *Ilybius oblitus* Sharp 1882

Figs. 169H; 170Q, R

Ilybius oblitus Sharp 1882*a*: 560.

Selected References. Michael and Matta 1977: 37 – 38; Larson 1987*b*: 379 – 382.

Description. Length = 8.9 to 10.7 mm; width = 4.9 to 5.5 mm; length: width = 1.74 to 1.89. Size moderate, relatively broadly oval.

Color of dorsal surface piceous to black medially, head with anterior margin and frontal spots and lateral margins of pronotum and elytra reddish, grading shortly into darker color of disc. Antenna and palpi entirely pale. Ventral surface of body reddish to piceous.

Elytron with sculpture coarse, lines deeply impressed and broad, meshes of irregular size but for most part small and rounded but some slightly stretched longitudinally basomedially and, on some specimens, meshes just posterad of middle slightly transverse. Meshes with evident microreticulation apically but smooth on basal half.

Prosternal process short and broad, medially narrowly rounded and not carinate; metasternal impression in which it is received short, on most specimens not attaining level of hind margin of mesocoxal cavities. Metasternal wing very narrow, width of metacoxa: width metasternal wing = 5.10 to 6.32.

Metacoxal plate with strioles deeply impressed, dense and elongate, and forming more or less continuous subparallel lines across length of plate. Metacoxal lines relatively little diverging, not reaching metasternum. Metafemur with short oblique strioles on ventral face. Metatibia with ventral face finely and sparsely punctate except for coarse punctures at base and along inner margin; longer metatibial spur subequal to or longer than metatarsomere 1; metatarsomere 1 lacking ventrolateral coarse setae.

Male protarsal claws sinuate ventrally, posterior claw with a deep ventrobasal emargination. Metacoxae with median line bearing a small longitudinal keel on posterior portion. Metatarsomeres lacking a dorsolateral bead. Dorsal metatarsal claw (Fig. 169H) narrowed more or less evenly to arcuate apex. Sternum 6 broadly rounded apically, with a complete marginal bead; surface smooth, lacking rugae or with only faint, broad longitudinal impressions posterolaterally; posteromedial keel absent but a slight low posteromedial longitudinal swelling or tumid area evident. Subgenital plate broad apically, it and lateral plates strongly strigate. Paramere (Fig. 170Q) with sucker hairs sparse, of unequal lengths. Aedeagus (Fig. 170R) simple, with apex obliquely rounded.

Female metatibia along internal margin and metatarsomeres along external margin lacking natatorial setae. Sternum 6 with apical emargination narrow and shallow, sternum margined laterally and on angles of emargination; emargination with lateral angles obtuse, sides slightly compressed in posterior aspect and middle produced into a well developed ridge.

Ecology. Larson (1987) reported specimens from among emergent grasses and rushes at the edge of a flooded borrow pit in southern New Jersey. The water was clear and warm and the bottom composed of sand covered with plant debris. Michael and Matta (1977) stated the habitat is somewhat similar to that of *I. biguttulus* except the species seems to prefer ponds without detritus or leaf litter. The only flight record is for a specimen collected at light on June 23, 1907, in Washington, D.C.

Distribution. The range extends from New York and Michigan to northern Florida and west to Kansas. There are no Canadian records but the species is likely to be discovered in southern Ontario as it occurs in adjacent states.

9. *Ilybius angustior* (Gyllenhal 1808)

Figs. 168; 169I; 171D

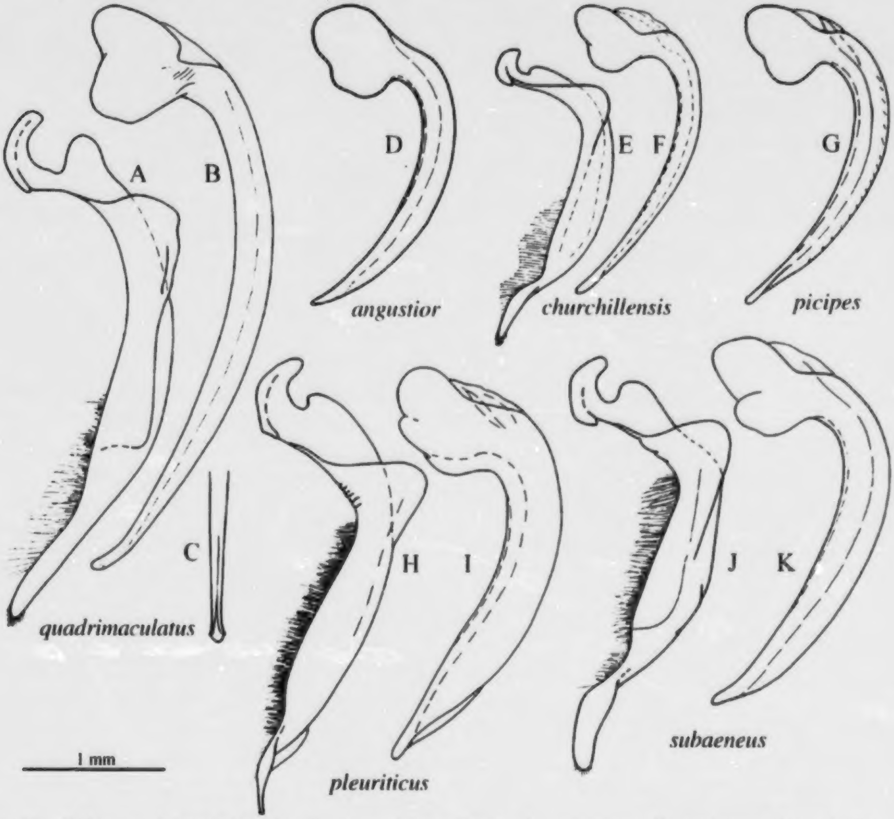


Fig. 171. *Ilybius*, male genitalia. A - C - *I. quadrimaculatus*. A - paramere. B - aedeagus, lateral. C - aedeagus apex, dorsal. D - *I. angustior*, aedeagus lateral. E, F - *I. churchillensis*. E - paramere. F - aedeagus, lateral. G - *I. picipes*, aedeagus lateral. H, I - *I. pleuriticus*. H - paramere. I - aedeagus, lateral. J, K - *I. subaeneus*. J - paramere. K - aedeagus, lateral.

Dytiscus angustior Gyllenhal 1808: 500.

Selected Reference. Larson 1987*b*: 382 – 386; Hilsenhoff 1993*c*: 193; Nilsson and Holmen 1995: 123 – 124; Larson 1997*b*: 511.

Description. Length = 7.5 to 10.2 mm; width = 4.0 to 5.3 mm; length: width = 1.81 to 2.03. Small to moderate size, shape elongate (Fig. 168).

Head black dorsally except frontal spots between eyes and anterior margin reddish; antenna yellow with outer antennomeres infuscate apically (palest specimens with at least apical antennomere infuscate medially); palpi yellow with apical palpomere of each palpus infuscate medially on most specimens. Pronotum with disc black, lateral margin narrowly reddish or piceous and evenly darkened onto disc. Elytra of most specimens piceous and not fully black, lateral margins and epipleura reddish; disc may be shiny with a faint metallic sheen or dull. Ventral surface of body piceous to black, legs dark red.

Elytron with meshes of sculpture small, laterally rounded but irregular in size and shape; without regular pattern of orientation or stretching and with little tendency of fusion of adjacent meshes. Meshes microreticulate with reticulation shallow and somewhat effaced basally.

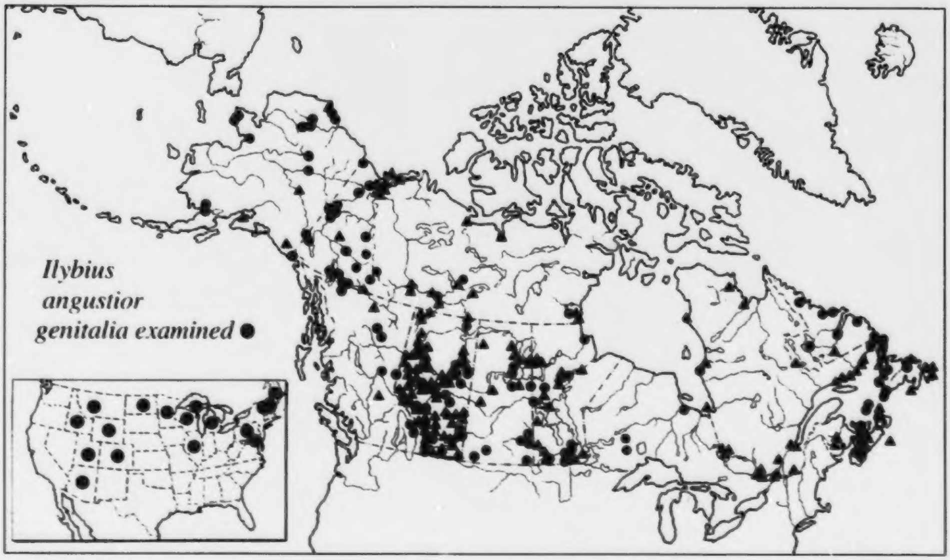
Prosternal process of only moderate length, apex acuminate; lateral bead well developed but not especially inflated between procoxae, distinct along lateral margin to apex; process strongly tectiform and sides not noticeably explanate immediately posterad to procoxae; in ventral aspect shape lanceolate. Metasternum with anteromedial impression extended posteriorly to level of hind margin of mesocoxal cavities. Metasternal wings broad, width of metacoxa: width metasternal wing = 2.04 to 2.82. Metacoxal plate finely reticulate; strioles fine and numerous, irregular with considerable joining and intersection of lines; punctures numerous and situated in strioles. Metacoxal lines faintly sinuate, elongate but not reaching metasternum. Metafemur relatively densely punctate but punctures not elongate or linear. Metatibia with a series of coarse punctures extending entire length of ventral face, density of punctures various but on average specimens of *I. angustior* have the metatibia more densely and coarsely punctate than do specimens of *I. picipes*. Longer metatibial spur subequal to or slightly shorter than metatarsomere 1. Metatarsomere 1 without dorsomedial setae but with from 1 to several stout spines along ventrolateral margin.

Male protarsus with posterior claw narrower and more arcuate than anterior, both straighter than respective claws of *I. picipes*. Metacoxae with a small posteromedial keel. Metatarsomeres with a dorsolateral bead or ridge. Metatarsal claws (Fig. 169I) with dorsal claw blade-like, shallowly emarginate externobasally and evidently broadened medially. Sternum 6 with a posteromedial longitudinal keel, hind surface lateral to keel with strong longitudinal rugae. Subgenital plate broad and truncate apically, broader than that of *I. picipes*, longitudinally strigate laterally; lateral plates longitudinally strigate. Paramere narrow, with sucker hairs on mesal face. Aedeagus (Fig. 171D) narrow, apex slightly reflexed ventrally and evidently narrowed in lateral aspect.

Female metafemur along internal margin and metatarsomeres along outer margin lacking natatorial setae. Sternum 6 with posteromedial emargination well developed, its sides not appreciably pinched in posterior aspect; marginal bead complete around lateral angles of emargination. Gonocoxa with dorsal margin more curved at base and apex more abruptly pointed than that of *I. picipes*.

Ecology. This species occurs primarily in forested regions, in lentic sites where the water is shaded by dense stands of emergent vegetation, usually *Carex*. Specimens have been collected from prairie ponds but are seldom common in such habitats and are usually in transitional areas such as parkland or fescue prairie. The range of habitat overlap with other *Ilybius* species given by Larson (1985) is too broad and most co-occurrences with *I. discedens* are probably referable to *I. picipes*. Alarie and Maire (1991) found that in a region of northern Quebec where both *I. angustior* and *I. picipes* occurred, there was a habitat separation. *Ilybius picipes* occurred more in wetlands, especially palsa bogs, whereas *I. angustior* was more in rock-pools. Nilsson (1981c) described the larva and the life history in Sweden. Flight records extend from June 28 to July 14, with one record for October 1.

Distribution. Map 223. The range is Holarctic and primarily boreal. In North America the distribution extends from Newfoundland and Sable Island to Nome, Alaska, and from the arctic coast in the west, south along the Rocky Mountains to Colorado and Arizona.



Map 223. *Ilybius angustior* (Gyllenhal). Canadian and Alaskan collection localities and United States state records.

10. *Ilybius churchillensis* Wallis 1939

Figs. 169J; 171E, F

Ilybius churchillensis Wallis 1939*b*: 195. Type locality - Churchill, Manitoba.

Selected Reference. Larson 1987*b*: 387 – 388.

Description. Length = 7.2 to 8.6 mm; width = 3.7 to 4.3 mm; length: width = 1.89 to 2.08. Similar to *I. angustior* but smaller and narrower and with narrower metasternal wings.

Color of dorsal surface mainly black, relatively shiny, specimens from the type locality with a green reflection but all other specimens examined lack green sheen. Frontal spots, anterior margin of clypeus, mouthparts and lateral margin of pronotum rufescent; elytron with lateral margin faintly piceous. Antenna yellow with distal antennomeres (on most specimens beginning antennomeres 3 -5) distinctly infuscate; palpi of most specimens with distal palpomere infuscate apically. Legs dark rufous to piceous.

Elytron with meshes of sculpture coarser and more irregular in shape than on *I. angustior*, meshes without evident pattern of orientation or stretching; microreticulation evident apically but surface relatively shiny basally where microreticulation is only faintly impressed or absent.

Prosternal process short, apex acuminate and somewhat deflected upwards behind procoxae and out of plane of midline of prosternum in lateral aspect. Metasternal impression not or only just attaining level of hind margin of mesocoxal cavities. Metasternal wing narrower than in *I. angustior*, width of metacoxa: width metasternal wing = 2.44 to 3.64. Metacoxal plates with strioles sparser and shorter than in *I.*

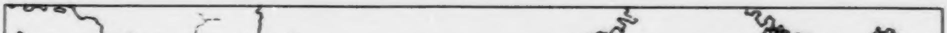
angustior; strioles irregularly orientated and variously interconnected especially medially on plate; on some specimens strioles obscured by coarse reticulation and transverse rugae of plate; small punctures present both between and in strioles. Metacoxal lines slightly arcuate anteriorly, finely traceable to metasternum or not. Metafemur finely punctate, without strioles. Metatibia with a series of coarse punctures along length of ventral face, punctures either forming a narrow medial series or punctate area expanded over most of ventral surface. Metatibial spurs slightly shorter than metatarsomere 1. Metatarsomere 1 with one to several ventrolateral setae.

Male protarsal claws slender, similar to those of *I. angustior*. Metacoxae with a small medial keel on posterior portion of medial line. Metatarsomeres with a dorsolateral ridge; metatarsal claws (Fig. 169J) slender, dorsal claw narrow and blade-like, its ventral (outer) margin not or only slightly expanded medially. Sternum 6 with a posteromedial keel, hind margin laterad to keel with coarse longitudinal rugae. Subgenital plates strigate. Aedeagus (Fig. 171F) slender, apex slightly reflexed ventrad and narrowly rounded.

Female metatibia along inner margin and metatarsomeres externally lacking natatorial setae. Sternum 6 with medial emargination well developed, lateral angles rounded with a complete marginal bead; sides of emargination slightly pinched in posterior aspect.

Ecology. Specimens of *I. churchillensis* have been collected from tundra pools in upland habitat near the Mackenzie River delta. There are no flight records.

Distribution. Map 224. The species is known from only a few localities on the western arctic mainland, ranging from Churchill, Manitoba, to northern Alaska.



Map 224. *Ilybius churchillensis* Wallis. Canadian and Alaskan collection localities and United States state records.

11. *Ilybius picipes* (Kirby, 1837)

Figs. 169K; 171G

Colymbetes picipes Kirby 1837: 17. Lectotype - male in BMNH labelled: H.T. [Hudson Bay Territories], North America. Selected by Persson 1985.

Selected References. Larson 1987*b*: 388 – 391; Hilsenhoff 1993*c*: 195; Nilsson and Holmen 1995: 124; Larson 1997*b*: 511.

Description. Length = 8.0 to 9.5 mm, width = 4.1 to 5.0 mm; length: width = 1.84 to 2.01. Similar to *I. angustior* and only the males can be recognized with confidence, the females are almost indistinguishable.

Color averaging darker than on *I. angustior*, specimens usually with dorsal surface black medially, never with a metallic sheen. Antenna yellow with at least apical antennomere infuscate medially; palpi entirely pale or with apical palpomere of each palpus infuscate. Ventral surface of body piceous to black; legs dark rufous to piceous.

Elytron with meshes of sculpture small, irregular in size and shape but generally somewhat rounded; lines deeper than in *I. angustior* and meshes more convex; microreticulation present apically but obsolete basally on most specimens. Elytra less shiny macroscopically, on average, than those of *I. angustior*.

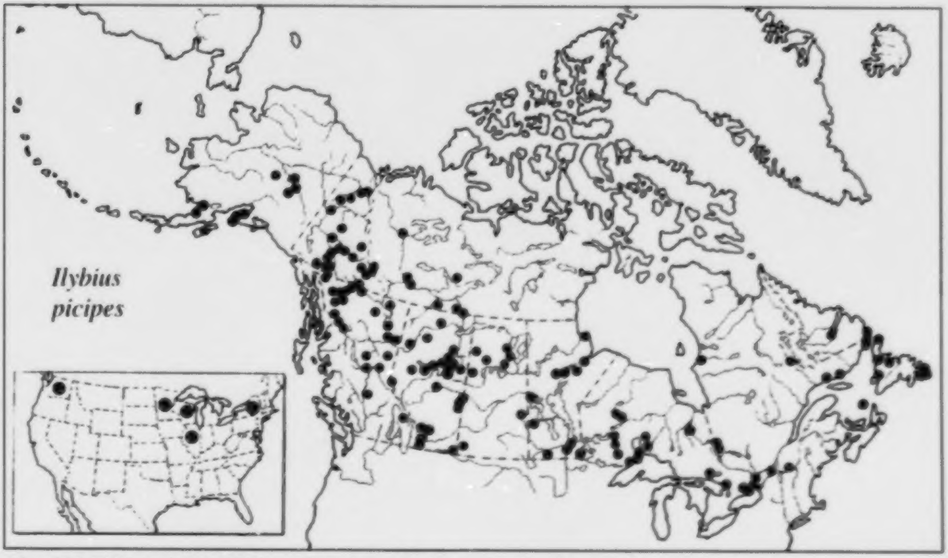
Prosternal process and metasternum similar to that of *I. angustior* but differing as follows: lateral bead slightly broader between and behind procoxae, in ventral aspect process broader with sides evidently explanate at point of maximum width and shape of process more cordate. Metasternal wing broad, width of metacoxa: width metasternal wing = 2.37 to 2.78, population means greater than for *I. angustior*. Metacoxal plate with strioles elongate, irregular and variously intersecting to form an irregular meshwork. Metacoxal lines slightly sinuate, not or only faintly traceable to metasternum. Metafemur punctate but lacking short. oblique strioles. Metatibia with coarse punctures along entire ventral face. Larger metatibial spur subequal to metatarsomere 1. Metatarsomere 1 with one to several spines along ventroexternal margin.

Male protarsal claws shorter, broader and more arcuate than those of *I. angustior*. Metacoxae with a small posteromedial longitudinal keel. Metatarsomeres with a dorsoexternal ridge, ridge narrower than on *I. angustior*, especially on metatarsomere 4. Dorsal metatarsal claw (Fig. 169K) narrower than in *I. angustior*, not evidently widened near middle. Sternum 6 and paramere as in *I. angustior*. Subgenital plate narrower apically than in *I. angustior*. Aedeagus (Fig. 171G) with apex subparallel, bluntly pointed and not reflexed ventrally in lateral aspect.

Female similar to *I. angustior*. Gonocoxa with dorsal margin straighter and apex more evenly tapered to a point than in *I. angustior*.

Ecology. *I. picipes* occurs in peatland pools in Newfoundland and Labrador whereas *I. angustior* has a broader range of habitats which includes both peatland pools and marshes. Nilsson and Holman (1995) state that in the northern boreal zone of Europe, *I. picipes* seems to prefer semi- permanent forest ponds whereas *I. angustior* occurs more in open, nutrient-rich sites. The larvae is indistinguishable from that of *I. angustior* (Nilson 1981*c*). Flight records exist for June 4 and 27.

Distribution. Map 225. *Ilybius picipes* has a Holarctic distribution. In North America it is transcontinental in the boreal region.



Map 225. *Ilybius picipes* (Kirby). Canadian and Alaskan collection localities and United States state records.

12. *Ilybius quadrimaculatus* Aubé 1838

Figs. 169L; 171A – C

Ilybius quadrimaculatus Aubé 1838*b*: 274.

Selected Reference. Larson 1987*b*: 391 – 393.

Description. Length = 9.5 to 11.1 mm; width = 5.0 to 6.0 mm; length: width = 1.81 to 1.87. Moderate size, elongate-oval.

Color of body very dark, mainly black with anterior margin of clypeus, labrum, frontal spots, narrow lateral margin of pronotum and legs, dark rufous. Elytron with small postmedial vitta and subapical crescentic spot distinct on most specimens; disc medially faintly cupreous or aeneous on some specimens. Antenna rufous except antennomeres 5 to 11 infuscate apically (palest specimens with at least antennomeres 10 and 11 infuscate apically). Palpi pale with terminal palpomeres infuscate apically.

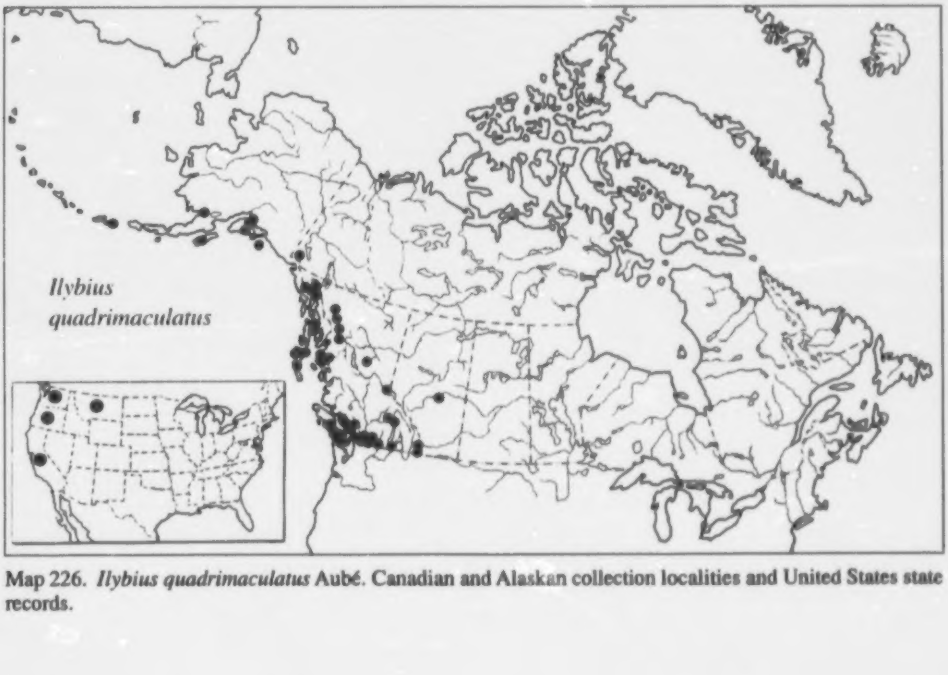
Elytron shiny, meshes of sculpture relatively small, irregular in size and shape, on basal half of disc some meshes elongated or oblique but without forming distinct pattern of longitudinal stretching.

Prosternal process elongate and apically acuminate; in cross section strongly tectiform but narrowly rounded medially; sparsely setose basally but glabrous apically. Metasternal impression well developed and posteriorly attaining level of hind margin of mesocoxal cavities. Metasternal wings moderately broad, width of metacoxa: width metasternal wing = 2.48 to 2.95. Metacoxal plate shiny, with lightly impressed isodiametric sculpture and distinct but short and mainly separated strioles, strioles fine and relatively sparse; punctation evident. Metacoxal lines slightly arcuate anteriorly, not attaining metasternum. Metafemur with numerous distinct but small punctures, strioles absent. Metatibia with coarse punctures on basal third to half of ventral face, distally with sparse fine punctures except for row of coarse punctures along ventral mesal margin. Longer metatibial spur slightly longer than metatarsomere 1. Metatarsomere 1 without coarse ventral setae along ventrolateral margin.

Male anterior protarsal claw anterior claw with a distinct ventrobasal sinus; posterior claw shorter and narrower than anterior, with a distinct ventrobasal emargination. Metacoxae with a small posteromedial longitudinal keel. Metatarsomeres 1 to 4 with a dorsoexternal bead; dorsal metatarsal claw (Fig. 169L) evenly narrowed to curved apex. Sternum 6 with a large posteromedial longitudinal keel, hind margin lateral to keel with coarse longitudinal rugae; marginal bead obsolete medially. Subgenital plate relatively narrow, truncate to shallowly and broadly emarginate apically, it and lateral plates strongly longitudinally rugose. Paramere (Fig. 171A) bearing short adhesive setae on mesal face. Aedeagus (Fig. 171B, C) elongate, longer than paramere and with apex spear-shaped in dorsal aspect.

Female metatibia with mesal margin and metatarsomeres 1 to 3 with outer margins lacking natatorial setae. Sternum 6 shallowly and narrowly emarginate apically, lateral angle of emargination bluntly rounded and obtuse; in posterior aspect sides of emargination slightly pinched and medial portion raised as a distinct knob, this elevated knob extended anterad on sternum as a low but evident convexity traceable on many specimens over most of midline of sternum, many specimens with a fine longitudinal impression along middle of convexity just anterad of medial knob; lateral bead continuous around lateral angles of emargination.

Ecology. This species occurs among emergent vegetation of permanent marshes, beaver ponds and backwater depositional zones of very slowly flowing streams. Specimens are often found in sites where the water is cool and there is some degree of flushing either by springs or the proximity of larger streams. There are no records of flight.



Map 226. *Ilybius quadrimaculatus* Aubé. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 226. The range of this species extends from the Aleutian Islands south to central California and east to the eastern slopes of the Rocky Mountains.

13. *Ilybius pleuriticus* LeConte 1850
Figs. 169M; 171H, I

Ilybius pleuriticus LeConte 1850: 213. Type locality - Lake Superior.

Selected References. Larson 1987*b*: 393 – 396; Hilsenhoff 1993*c*: 195; Larson 1997*b*: 511.

Description. Length = 10.2 to 12.6 mm; width = 5.5 to 7.0 mm; length: width = 1.76 to 2.00. Large, body moderately broad.

Color of dorsal surface piceous medially, with a faint brassy sheen on some specimens; lateral margins of body evidently reddish. Head with frontal spots, anterior portion of clypeus and labrum, rufous. Antenna and palpi pale, without infuscation. Pronotum with lateral margins broadly reddish, most specimens with anterolateral angle red. Elytron with epipleuron and lateral margin broadly reddish, on some specimens reddish area extends onto disc almost to level of sublateral vitta; lateral and subapical spots evident. Ventral surface variously reddish to piceous; legs reddish.

Elytron with sculpture various, some specimens with meshes small and irregular in size but similar over most of disc; most specimens with meshes basally and medially very irregular in size and shape and appearing as though fusion of adjacent meshes has occurred to produce fewer elongated or curved meshes; microreticulation present but on many specimens is more or less effaced on basal portions of elytron.

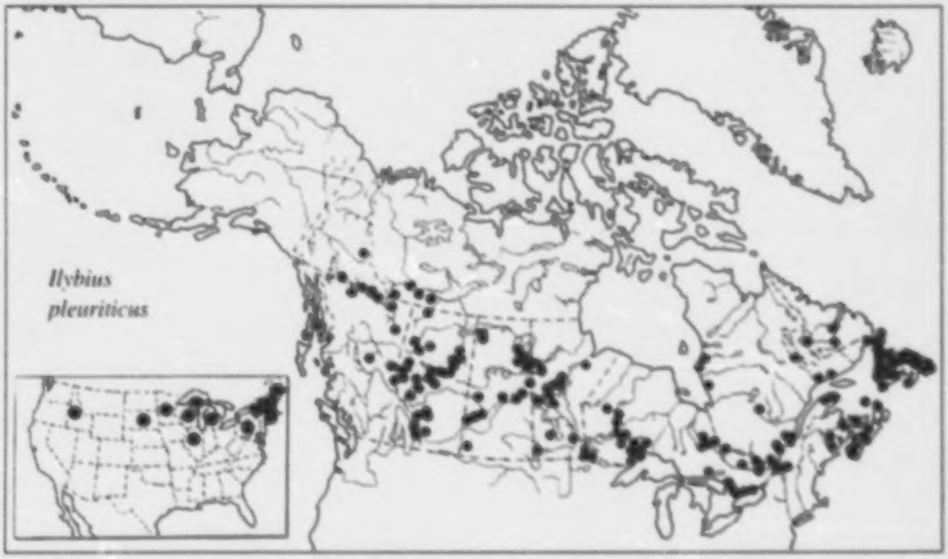
Prosternum with process moderately elongate and apically acuminate, tectiform in cross section with medial convexity narrowly rounded; lateral bead of process slightly broadened between and behind procoxae. Metasternal impression extending posteriorly to level of hind margin of mesocoxal cavities. Metasternal wings broad, width of metacoxa: width metasternal wing = 2.5 to 3.2. Metacoxal plates with short to moderately elongate, dense but mainly separate strioles; sparse punctation evident. Metacoxal lines not attaining metasternum but longer than in *I. subaeneus*. Metafemur finely punctate, a few punctures along hind margin obliquely elongated forming fine strioles. Metatibia with punctures extending length of ventral face on most specimens but punctures irregular in size, usually coarse basally becoming finer towards distal half, or on some specimens punctures may be more or less obsolete on distal half. Longer metatibial spur slightly longer than metatarsomere 1. Metatarsomere 1 lacking ventrolateral coarse setae.

Male anterior protarsal claw with basoventral sinus small; posterior claw with a distinct basoventral emargination. Metacoxae with a small medial keel. Metatarsomeres 1 to 4 with a dorsoventral ridge; dorsal metatarsal claw (Fig. 169M) blade-like, slightly sinuate ventrally. Sternum 6 with a short posteromedial longitudinal carina; posterolateral portions without longitudinal rugae or with a few shallow rugae but punctures evident; apex broadly rounded or subtruncate medially; marginal bead fine or obsolete medially. Subgenital plate truncate or shallowly emarginate apically, it and lateral plates with strong longitudinal rugae. Paramere (Fig. 171H) bearing numerous large, adhesive suckers along ventral margin. Aedeagus (Fig. 171I) short and blunt.

Female metatibia with internal margin and metatarsomeres with external margins lacking natatorial setae. Sternum 6 relatively deeply emarginate medially; sides of emargination distinctly pinched in posterior aspect with middle somewhat produced; marginal bead of sternum broken or obsolete on externoapical angles of emargination and not traceable on most individuals (on some specimens bead is shallow but evident on outer angles of medial emargination).

Ecology. This species occurs in a rather wide range of permanent, lentic habitats, including *Carex* and rush-filled marshes, amongst emergent vegetation along sheltered lake shores, and at the edges of larger ponds in peatlands (Larson and House 1990). Flight records exist for May 30 and July 7 and 15.

Distribution. Map 227. This species occurs from Newfoundland to the Yukon Territories in the boreal zone.



Map 227. *Ilybius pleuriticus* (LeConte). Canadian and Alaskan collection localities and United States state records.

14. *Ilybius subaeneus* Erichson 1837

Figs. 169N; 171J, K

Ilybius subaeneus Erichson 1837: 156. Type locality - Berlin, Germany.

Selected References. Larson 1987*b*: 396 – 399; Nilsson and Holmen 1995: 125 – 126; Larson 1997*b*: 511.

Description. Length = 9.2 to 11.1 mm; width = 4.7 to 6.0 mm; length: width = 1.76 to 1.92. Moderately large, oval.

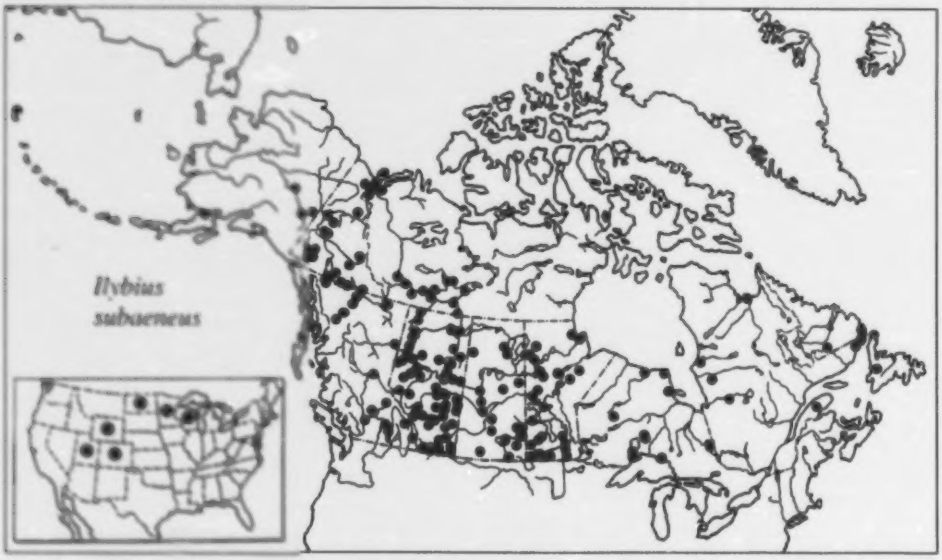
Body dorsally mainly piceous to black with a distinct greenish sheen on most specimens. Anterior portion of head, frontal spots and lateral margins of pronotum and elytra reddish. Antenna and palpi entirely yellow. Ventral surface piceous. Legs reddish.

Elytron with meshes small, irregular in size and shape and without as pronounced a tendency of longitudinal or lateral elongation as in *I. pleuriticus*; meshes not longitudinally stretched on basomedial portion of disc.

Prosternal process elongate, acutely pointed apically; medial convexity narrower than in *I. pleuriticus*, carinate on apical half of process; lateral bead not or only slightly inflated between and behind procoxae. Metasternal impression well developed and extending posteriorly to level of hind margin of mesocoxal cavities. Metasternal wings broad, width of metacoxa: width metasternal wing = 2.32 to 2.65. Metacoxal plate with short strioles, strioles longest, densest and somewhat interconnected laterally, shorter and more or less isolated mesad on plate. Metacoxal lines short, disappearing well posterad of metasternum. Metafemur with small punctures, some punctures along posterior margin elongate in form of short fine strioles. Metatibia with coarse punctures along length of ventral face. Longer metatibial spur subequal in length to metatarsomere 1. Metatarsomeres lacking coarse dorsal and ventral setae.

Male posterior protarsal claw narrow, ventral emargination broad and subbasal. Metacoxae with a short longitudinal keel on posterior portion of medial line. Metatarsomeres 1 to 3 with a dorsolateral bead; dorsal metatarsal claw (Fig. 169N) broadly arcuate and tapering to apex. Sternum 6 with numerous coarse longitudinal rugae along posterior margin, these rugae obscuring setiferous punctures; a distinct medial longitudinal keel lacking. Subgenital plate broadly rounded to subtruncate apically, it and lateral plates coarsely longitudinally rugose; lateral bead obsolete across rugose portion of sternum. Paramere (Fig. 171J) bearing numerous adhesive setae along mesal face. Aedeagus (Fig. 171K) short, apex simple.

Female metatibia with mesal margin and metatarsomeres with lateral margin lacking natatorial setae. Sternum 6 emarginate medially, lateral bead continuous around lateral angles of emargination.



Map 228. *Ilybius subaeneus* (Erichson). Canadian and Alaskan collection localities and United States state records.

Ecology. This species occurs in shallow, sun-warmed, usually permanent or semipermanent lentic habitats. Specimens occur among emergent vegetation in both forest and grassland ponds. In Labrador, specimens are found principally in shallow water along sheltered lake shores, either among emergent plants or frequently on bare gravel or sand substrates. The larva has been described (Balfour-Browne 1950, Nilsson 1982c). There is a record of flight, July 26.

Distribution. Map 228. The species is Holarctic. The North American range extends from the Northern Peninsula of Newfoundland, to the Aleutian Islands, Alaska, and in the west from the Mackenzie Delta to alpine areas of Colorado.

Genus *Agabinus* Crotch 1873

Fig. 172

Agabinus Crotch 1873: 397. Type species - *Colymbetes glabrellus* Motschoulsky 1859, by original designation.

Diagnosis. Length = 4.9 to 6.7 mm, body (Fig. 172A) broadly oval in outline, dorsoventrally depressed. Color mainly black. Sculpture consisting of fine lines forming large, irregular meshes; meshes finely punctate.

Clypeus with anterolateral foveae elongate, not forming a continuous submarginal groove, or forming a very narrow, irregularly broken groove. Antenna elongate, antennomeres slender. Palpi normal. Eyes large, anterior emargination relatively small. Pronotum distinctly margined laterally. Prosternum and its process in same plane, prosternum with anterior margin very slightly and broadly angulate medially; prosternal process broad basally, acutely pointed apically, sides broadly margined basally but lateral margin not extending to apex. Metasternum with anteromedial impression sharply defined, extending posteriorly to level of hind margin of mesocoxal cavities. Metacoxae (Fig. 172B) with coxal lines strong, subparallel from metasternum to apex of metacoxal processes, and processes rounded only along posterior margin; process covering base of metafemur. Metafemur clavate, narrow basally, expanded and ventrally convex distally; posterolateral angle broadly rounded, comb of setae oblique relative to longitudinal axis of femur. Natatorial setae lacking from posterior margin of metatibia and outer margin of metatarsus of both sexes.

Male with tarsomeres 1 and 2 of pro- and mesotarsi slightly dilated and each bearing a small tuft of pale setae beneath; protarsal claws not modified. Paramere (Fig. 172C) stylate; aedeagus (fig. 172D, F) simple, more or less evenly arcuate in lateral aspect.

Comments. This small genus is restricted to western North America where the two species occur along the margins of streams. The skid-like shape of the metacoxal processes and the narrow legs and limited movement of the metafemur suggest adaptations for living interstitially or under cover. The aggregate range extends from southern British Columbia to California. Both included species occur in Canada.

The larva of *A. glabrellus* has been described by Alarie and Larson (1998). Larval chaetotaxy and porotaxy support inclusion of the genus in the tribe Agabini.

Key to species of *Agabinus*
(after Leech 1941*b*)

1. Metasternal wing broad, width of metacoxa: width metasternal wing = 1.9 to 2.5; elytron with meshes of sculpture flat and smooth ....1. *A. glabrellus* (Motschoulsky)

1'. Metasternal wing narrow, width of metacoxa: width metasternal wing = 3.5 to 4.1; elytron with many meshes of sculpture concave giving elytron a scaled or dimpled ....2. *A. sculpturellus* Zimmermann

1. *Agabinus glabrellus* (Motschoulsky 1859)
Fig. 172A, B, E, F

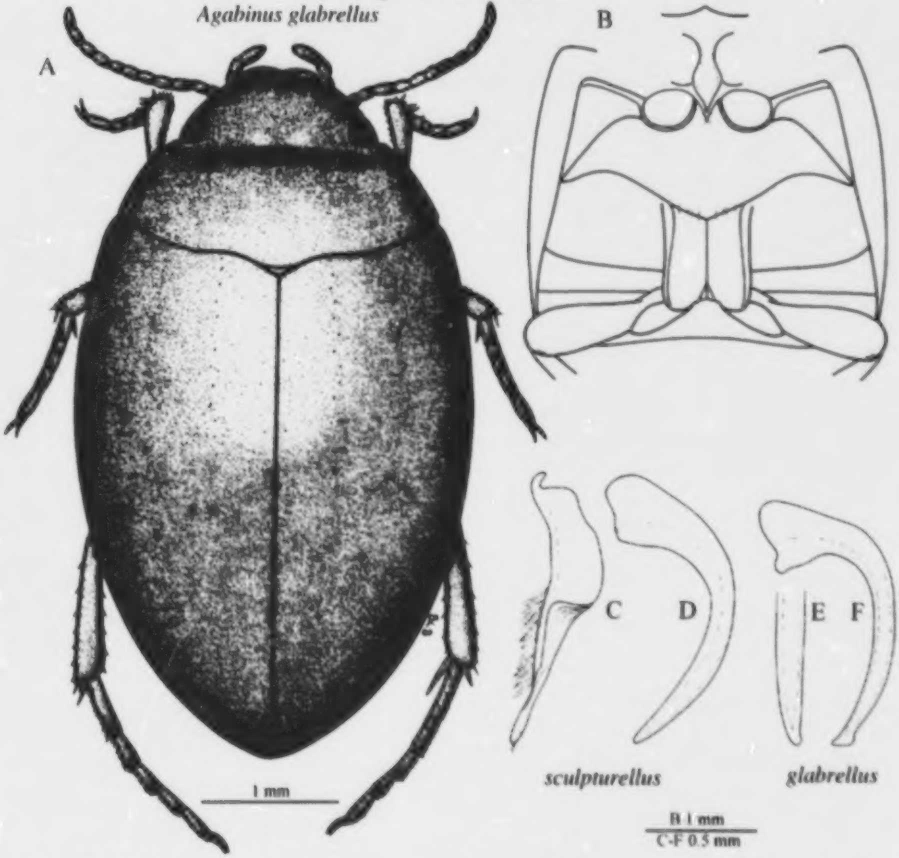


Fig. 172. *Agabinus*. A, B, E, F - *A. glabrellus*. A - habitus. B - thorax ventral. E - aedeagus, dorsal. F - aedeagus, lateral. C, D - *A. sculpturellus*. C - paramere. D - aedeagus, lateral.

Colymbetes glabrellus Motschoulsky 1859: 171–172. Type locality - San Francisco, California.

Selected Reference. Leech 1941*b*: 53.

Description. Length = 4.9 to 5.5 mm; width = 2.8 to 3.2 mm; length: width = 1.70 to 1.82. Body broadly oval (Fig. 172A).

Color shiny black except antenna and palpi yellow; anterior margin of clypeus, frontal spots, mouthparts and legs, reddish; margins of pronotum, metacoxal process and posterior margins of abdominal sterna, piceous.

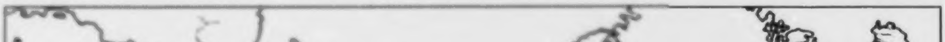
Sculpture of dorsum consisting of fine lines forming large irregular meshes; small punctures present both at intersections of lines and medially on meshes, each mesh usually with several punctures otherwise smooth and flat; lines and punctures deepest and densest medially on frons and lateral portions of pronotum, some specimens with lines partly effaced medially on pronotum and disc of elytron.

Pronotum with lateral bead broadest basally, narrowing anteriorly. Prosternal process with median convexity more or less evident along length. Metasternal wing broad, width of metacoxa: width metasternal wing = 1.88 to 2.50.

Aedeagus (Fig. 172E, F) with apex expanded and truncate in lateral aspect.

Ecology. Leech (1941*b*) considered the species common in mountain streams in California. He collected a B.C. specimen from a "pool of water at the end of a small irrigation flume." Specimens from Malahat, Vancouver Island, were found in a "spring run on a xeric hillside". Larvae have been collected in May and June from a small seasonal creek in Oregon (Alarie and Larson 1998).

Distribution. Map 229. The range extends from southwestern British Columbia to California. A specimen labelled "Texas" (in CNC) is almost certainly mislabelled.



Map 229. *Agabinus glabrellus* (Motschulsky). Canadian and Alaskan collection localities and United States state records.

2. *Agabinus sculpturellus* Zimmermann 1919

Fig. 172C, D

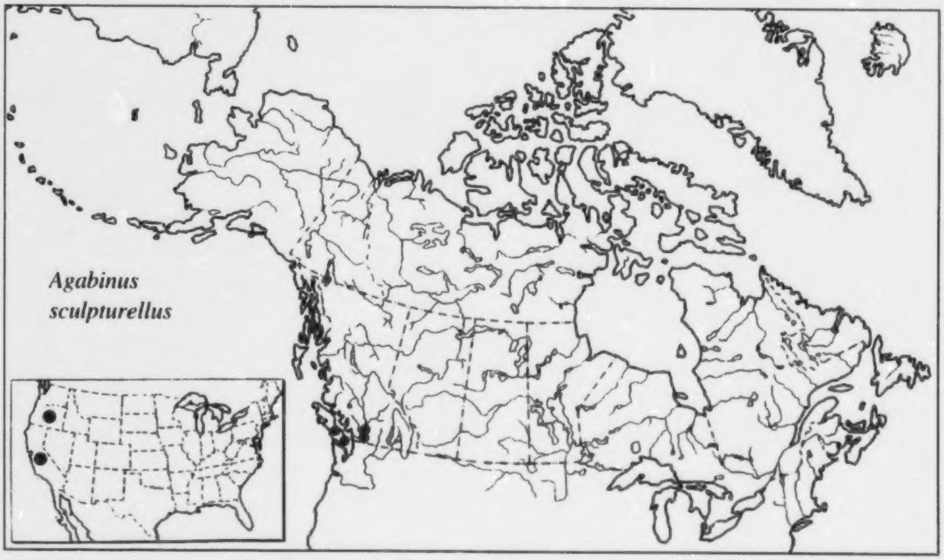
Agabinus sculpturellus Zimmermann 1919: 205. Type locality - Shasta Retreat, California.

Selected Reference. Leech 1941*b*: 53.

Description. Length = 6.2 to 6.7 mm, width = 3.5 to 3.8 mm; length: width = 1.75 to 1.80. Very similar to *A. glabrellus*, differing as follows: size a little larger; elytron with many meshes of sculpture with anterior margin slightly depressed giving elytron a scaled or dimpled appearance; pronotum with lateral bead of more or less uniform width along length; prosternal process broad, lowly and evenly convex in cross section; metasternal wing very narrow, width of metacoxa: width metasternal wing = 3.57 to 4.08; aedeagus (Fig. 172D) with apex evenly narrowed in lateral aspect.

Ecology. These insects occur along the margins of small streams in mountainous regions.

Distribution. Map 230. The range is largely sympatric with that of *A. glabrellus*, extending from southern British Columbia to California.



Map 230. *Agabinus sculpturellus* Zimmermann. Canadian and Alaskan collection localities and United States state records.

Tribe Coptotomini Van den Branden 1885

Diagnosis. Length = 5.7 to 8.6 mm; body (Fig. 173) elongate-oval, somewhat pointed posteriorly, deep and somewhat subcylindrical in cross-section.

Color yellow to pale red with dorsal surface variously maculate. Body dorsally with fine, dense punctures; female with punctures of pronotum and base of elytron elongated into short, fine strioles.

Clypeus with anterolateral foveae elongate but widely separated. Antennomeres slender. Eye with anterior margin emarginate. Palpi each with distal palpomere emarginate apically, somewhat mitten-shaped in lateral aspect. Pronotum with lateral bead. Prosternum anterior margin broadly and shallowly emarginate each side of middle; in lateral aspect with anterior portion vertical ending ventrally with an almost right-angled bend then continuous in plane with prosternal process; prosternal process elongate and acutely pointed apically, received into V-shaped impression on metasternum. Metasternal wing narrow. Metacoxa large; metacoxal lobes rounded, lines diverging anteriorly and more or less parallel with margin of metasternum, disappearing without contacting metasternum. Metatibia and metatarsomeres with natatorial setae in both sexes. Metatarsomeres 1 to 4 with externoapical angles lobed; metatarsal claws subequal.

Male with protarsomeres 1 to 3 narrowly dilated, together bearing four transverse rows of narrow scales on ventral surface. Genitalia with parameres similar in shape, each about half length of aedeagus, broadly triangular or subquadrate with a few long pale setae at apex; aedeagus in dorsal aspect with lateral margins asymmetrically expanded subapically, dorsal groove asymmetrical. Female with gonocoxa short, parallel-sided, membranous and setose.

Comments. This genus contains a single genus, *Coptotomus*, which is restricted to North America. The systematic position of the genus is unclear for it possesses a number of peculiar autapomorphies including emarginate apical palpomeres and larva with abdominal gills. The general habitus is similar to that of the southern hemisphere genus, *Lancetes* Sharp, but there are no other characters supporting a close relationship.

Genus *Coptotomus* Say 1834

Fig. 173

Coptotomus Say 1834: 443. Type species - *Coptotomus serripalpus* Say 1834: 443, by monotypy.

Diagnosis. With characteristics of the tribe.

Comments. This genus contains an uncertain number of species, but probably fewer than 10. The aggregate range includes most of southern Canada south of the boreal forest, the entire United States and northern Mexico. The species have been reviewed by Hilsenhoff (1980) who concluded that five species are represented in eastern North America and perhaps several additional species occur in western North America. Species definition is difficult because the species are morphologically very homogeneous. The principal characters for species recognition are width of the metasternal wing, color, sculpture, size and shape of the aedeagus, all of which are gradational without sharp

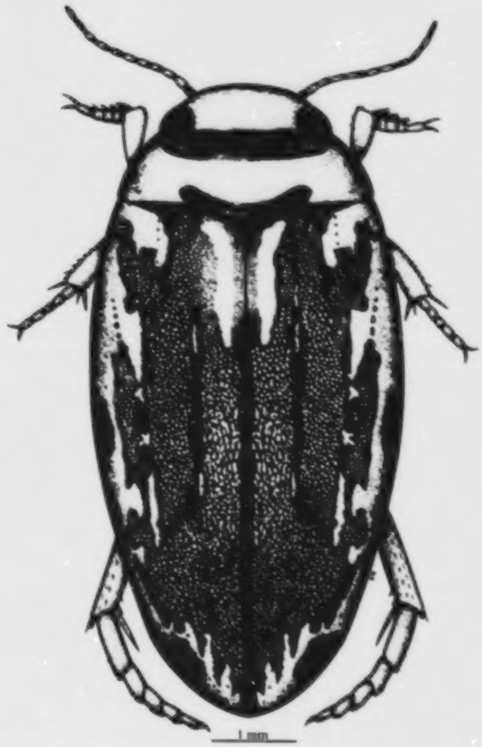


Fig. 173. *Coptotomus longulus* habitus.

discontinuities. Several forms exist in sympatry demonstrating that they are specifically distinct. For example, *C. loticus* and *C. longulus* both occur in southern Ontario and Quebec where they occupy different habitats and show no sign of intergradation. Specimens of *C. longulus* and *C. interrogatus* have been taken from the same pond in New Jersey. However, other species are parapatric and intergrade with one another along the zone of contact. For example, *C. longulus* and *C. lenticus*, which are generally readily separable, have a broad zone of intergradation in western Ontario and Manitoba so that these are best considered as subspecies of one widespread polytypic species. Similarly, *C. interrogatus*, *C. venustus* and *C. loticus* merge into one another in various regions of the southern United States and may prove to be geographical forms of another polytypic species. They are treated as full species here because a detailed geographical analysis of their variation has not been conducted. Hilsenhoff (1980) regarded *C. obscurus* Sharp as a junior synonym of *C. interrogatus* and could not make decisions as to the status of *C. difficilis* LeConte 1851 and *C. serripalpus* Say 1834. *Coptotomus difficilis* is known only from the uniquely colored holotype female from Colorado. *Coptotomus serripalpus* was described from Mexico, however the type is lost and the description is inadequate to characterize the species. Therefore, these species are omitted from the key. Hilsenhoff (1980) also suggested that additional species may occur in western North America. The genus requires revision with careful attention to patterns of geographical variation.

These insects occur in weedy areas of permanent ponds, lakes and slowly flowing streams. They are often found in deeper and more open water than are most other dytiscids.

Key species of *Coptotomus* of Canada and United States
(modified from Hilsenhoff 1980)

1. Metasternal wing broad, width at narrowest point adjacent to mesocoxa 0.35 mm or more (width of metacoxa: width metasternal wing = 4.0 to 6.5) . . . . .1. *C. longulus* LeConte complex

1'. Metasternal wing narrow, minimum width adjacent to mesocoxa 0.3 mm or less (width of metacoxa: width metasternal wing = 6.5 to 9.0) . . .2

2(1). Head between eyes pale reddish yellow with dark markings of posterior margin of head sharply delimited; elytron with lateral margin of discal cloud (pigmented area with irrorations) with four more or less prominent lateral lobes or spots, sublateral dark stripe or spot short and generally not extending into basal third; metasternal wing very narrow, average minimum width adjacent to mesocoxa = 0.23 mm; larger, length = 6.7 to 8.1 mm .2. *C. loticus* Hilsenhoff

2'. Head between eyes dark reddish yellow to brown with color merging more or less evenly into darker color of hind margin; elytron with lateral margin of discal cloud more or less straight or with distinct lateral lobes, sublateral dark stripe well developed; metasternal wing broader, minimum width adjacent to mesocoxa = 0.27 to 0.29; size smaller, length = 5.7 to 7.6 mm 3

3(2). Elytron with submarginal stripe extending anteriorly to basal fifth of elytron, continuous with lateral bead or narrowly separated by a slightly paler area; lateral margin of discal cloud more or less straight or at least without distinctive lateral lobes; aedeagus in dorsal aspect more abruptly widened at base of apical projection; Atlantic Coast, Massachusetts to Florida, Bahamas . . . . .*C. interrogatus* (Fabricius 1801)

3'. Elytron with lateral stripe variously developed, either not extending as far anteriorly or separated from lateral margin by a distinct paler area; lateral margin of discal cloud with distinct lateral lobes on many specimens; aedeagus in dorsal aspect less strongly widened subapically; Indiana and Missouri south to western Florida, Texas and Mexico . . . .*C. venustus* (Say 1823)

1. *Coptotomus longulus* LeConte 1852
Fig. 173

Coptotomus longulus LeConte 1852: 205. Type locality - Laramie, Wyoming.

Coptotomus lenticus Hilsenhoff 1980: 465 – 466. Type locality - Marquette Co., Wisconsin.

Selected References. Larson 1975: 377 – 378; Hilsenhoff 1980: 465 – 467; Hilsenhoff 1993*b*: 128 – 129.

Description. Length = 6.8 to 8.2 mm; width = 3.5 to 4.2 mm; length: width = 1.94 to 2.08. Habitus and color pattern as in Fig. 173.

Head pale except with sharply delimited dark marking along hind margin; antenna and palpi yellow. Pronotum pale with dark markings along anterior and posterior margins, these markings usually sharply limited on disc and not contiguous medially. Elytron with pattern of irrorations as in Fig 173; size and degree of fusion of irrorations various, forming an almost solid color on some specimens whereas on others only marginal and basal regions of pigmented areas of solid color (this variation has a geographical basis, see below); apical half of elytron with sublateral maculation more or less linear in lateral aspect.

Female elytron with punctures of basal half elongated into fine strioles, strioles relatively elongate and sinuate, their margins somewhat crenulate (seen at 100X magnification).

Metasternum relatively broad, width of metasternal wing adjacent to mesocoxa greater than 0.35 mm, width of metacoxa: width metasternal wing = 4.0 to 6.5.

Aedeagus in dorsal aspect with lateral margins relatively strongly expanded subapically.

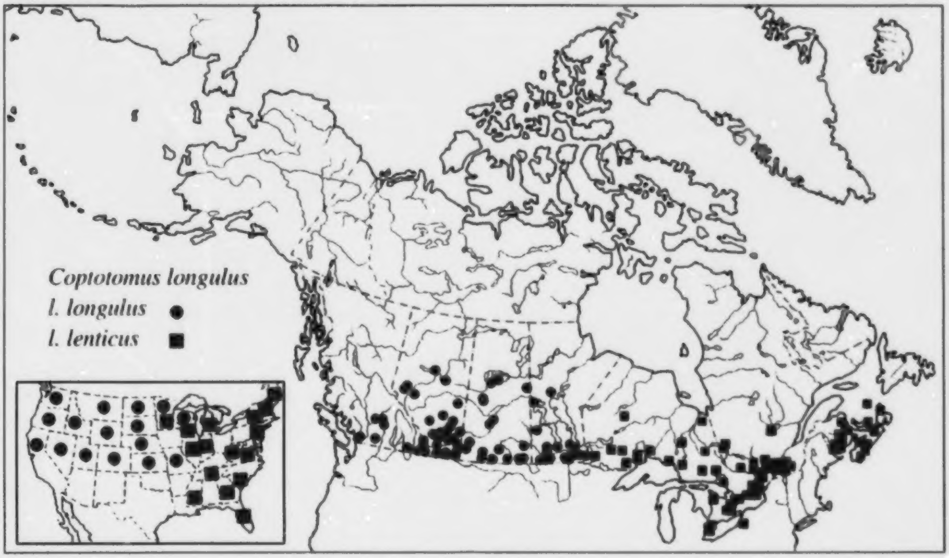
Comments. Hilsenhoff (1980) separated *C. lenticus* from *C. longulus* on the basis of its elytral maculations being darker and more solid in color, the metasternal wing a little narrower, and the lateral explanation of the aedeagus not as great. As so defined, *C. lenticus* occurs from Nova Scotia to eastern Manitoba whereas *C. longulus* occurs from Manitoba to British Columbia. However, specimens from Manitoba and western Ontario show all degrees of intermediate states in these characters. Evidently, hybridization occurs within this region so that the two forms should be considered conspecific. On the other hand, Hilsenhoff (1993*b)* did not observe hybridization in Wisconsin. Because of the Canadian pattern, recognition of two subspecies seems to be the best way of indicating that two distinctive geographical forms occur. Characteristics of the subspecies are:

Coptotomus longulus longulus LeConte - Color paler, pale color of pronotum yellow to reddish yellow; maculate portions of elytron more or less irrorate except along lateral and basal margins of pigmented area and along base of suture where pigment is more or less solid; metasternal wing broad, minimum width between meso- and metacoxa = 0.40 to 0.48 mm; aedeagus more broadly explanate laterally. Distribution - Manitoba to British Columbia to Manitoba.

Coptotomus longulus lenticus Hilsenhoff - Pronotum with ground color reddish yellow to pale red; elytron with maculations darker, solid color more or less continuous along suture to produce a sutural stripe, lateral and basal portions of maculate area with more solid color; metasternal wing narrow, minimum width between meso- and metacoxa = 0.35 to 0.40 mm; aedeagus narrower and less expanded laterally. Distribution - Nova Scotia to Manitoba.

Ecology. These insects occur in open, permanent ponds. They are often abundant in artificial ponds such as roadside barrow pits and stock ponds where there is rooted vegetation, usually *Typha*. Specimens have been collected at light in May, June and July. Teneral specimens have been collected as early as July 6 (Aweme, Manitoba) but most have been taken in late July and August.

Distribution. Map 231. The range is transcontinental in southern Canada. The species occurs throughout much of the United States but its status in the southwestern states requires study.



Map 231. ***Coptotomus longulus*** **LeConte. Canadian and Alaskan collection localities and United States state records.**

2. *Coptotomus loticus* Hilsenhoff 1980

Coptotomus loticus Hilsenhoff 1980: 467. Type locality - Wolf River, Outagamie Co., Wisconsin.

Selected Reference. Hilsenhoff 1980: 467; Hilsenhoff 1993*b*: 129.

Description. Length = 6.8 to 8.1 mm; width = 3.4 to 4.1 mm; length: width = 1.96 to 2.06. Similar to *C. longulus*, but readily recognized on the basis of elytral color and the narrower metasternal wing.

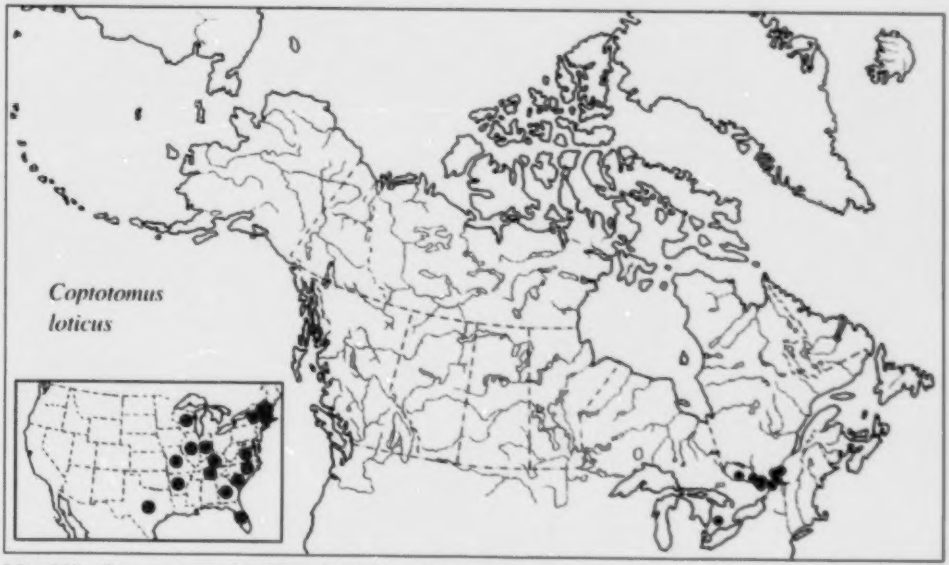
Color testaceous to reddish yellow with darker brown to piceous dorsal markings. Head reddish-yellow between eyes, dark area at base distinctly delimited. Pronotum with a broad dark mark along anterior emargination and with a somewhat bilobed basal dark marking of similar width, anterior and posterior marks separated on most specimens but some specimens with diffuse pigmentation mediolaterally making markings more or less continuous on each side of midline and leaving a medial paler spot. Elytron with dark areas mainly irrorate, consolidation of color principally along sutural margin and laterally to form four more or less distinct lobes or spots located subhumerally, medially, postmedially and subapically; sublateral stripe distinctly separated from lateral margin, at most extending along apical two-thirds of elytron but on most northern specimens reduced to a small spot near middle.

Metasternal wing narrow, minimum width adjacent to metacoxa = 0.22 to 0.25 mm, width of metacoxa: width metasternal wing = 7.5 to 9.0.

Aedeagus in dorsal aspect with lateral explanation relatively slight.

Ecology. The species has been most frequently collected from flowing waters where it occurs in weedy, very slowly moving stretches at the margins of streams. Specimens have been collected from embayments along the Ottawa River in Hull, Quebec. Hilsenhoff (1993) also recorded specimens from permanent ponds and lakes.

Distribution. Map 232. The range extends from southern Ontario and Quebec to Florida and Texas.



Map 232. *Coptotomus loticus* Hilsenhoff. Canadian and Alaskan collection localities and United States state records.

Tribe Matini Van den Branden 1885

Diagnosis. Size moderate, length = 5.4 to 9.5 mm; body (Fig. 174A) elongate-oval, depressed.

Color pale brown to piceous (black with longitudinal pale bands on elytra of some Australian species). Sculpture fine, dorsally consisting of fine isodiametric microreticulation or larger irregular meshes, with numerous small punctures.

Clypeus broadly emarginate medially; clypeal foveae well removed from anterior margin, elongate but not contiguous medially. Eye with anterior margin emarginate. Palpi and antenna unmodified, slender; mentum bifid. Pronotum with lateral bead well defined. Prosternum (Fig. 174B) and its process in same plane in lateral aspect, with a deep medial longitudinal groove, starting just behind anterior margin of prosternum and continuous to apex of process; process elongate, subparallel basally, sharply pointed apically, with a lateral bead basally but disappearing near apex. Metasternum anteromedially deeply impressed for reception of prosternal process. Metasternal wing very narrow laterally, appearing as a narrow, sinuate strap; anterior margin of metacoxa strongly arched anteriorly and attaining level of hind margin of mesocoxal cavities. Metacoxal lines diverging both anteriorly and posteriorly; metacoxal processes large and apically rounded. Metatrochanter large, about one-half length of metafemur; metafemur broad, slightly clavate, lacking setae on posteroapical angle; metatibial spurs long, longer spur slightly shorter than combined length of metatarsomeres 1 and 2. Metatarsi broad, apical margin of metatarsomeres 1 to 4 each with dorsal, and to a lesser extent, ventral margin produced apically; claws elongate and more or less straight, posterior claw (ventral) about twice length of anterior claw. Male with natatorial setae present on hind margin of metatibia and outer margin of metatarsomeres, these setae absent from female.

Male pro- and mesotarsomeres 1 to 3 broadened, clothed ventrally with apically flattened setae. Parameres (Fig. 175C, F) symmetrical, slender apically and subequal in length to longer than aedeagus. Aedeagus (Fig. 175E, H) with a prominent medioventral impression. Female gonocoxa elongate, lightly sclerotized, more or less cylindrical apically; apex with short setae, ventral margin with denser and longer setae.

Comments. This tribe contains three genera, *Matus* in North America, and *Allomatus* Mouchamps and *Batrachomatus* Clark in Australia. Each genus contains only a few species. Specimens of *Matus* are lentic and occur on soft substrates among dense vegetation and debris. The Australian forms are lotic and occur under cover along the margins of streams (Larson 1993).

Genus *Matus* Aubé 1836
Figs. 174; 175

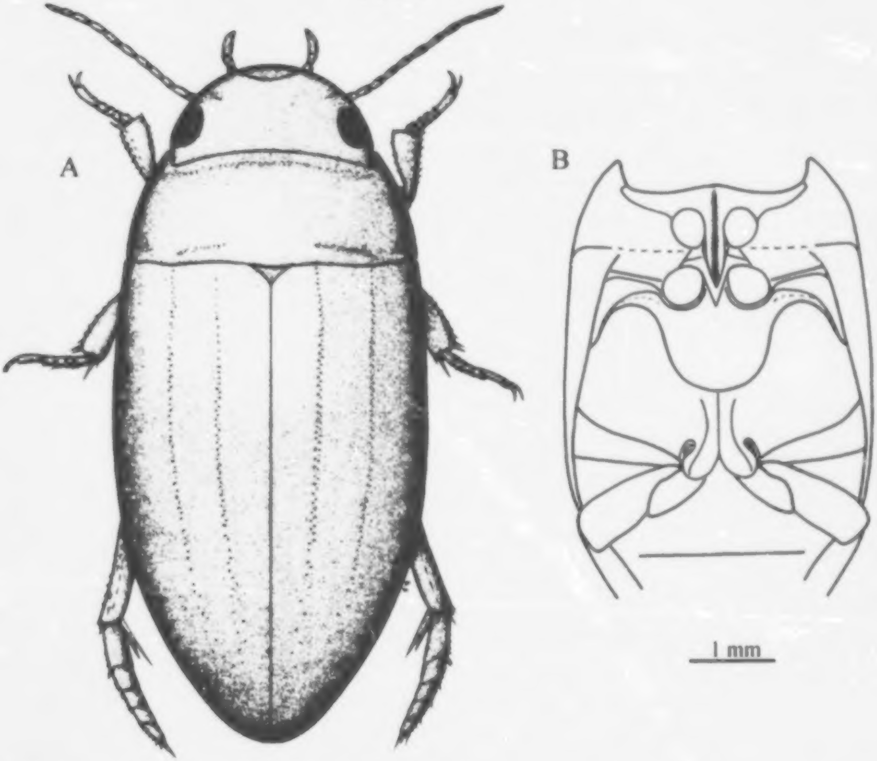


Fig. 174. *Matus ovatus*. A - habitus. B - thorax, ventral.

Matus Aubé 1836: 42. Type species - *Colymbetes bicarinatus* Say 1825, by subsequent monotypy of Aubé 1837: 189.

Diagnosis. With characteristics of the tribe. Length = 5.4 to 9.5 mm; length: width = 2.00 to 2.25, depressed. Color pale to dark brown. Sculpture dorsally consisting of fine isodiametric microreticulation with numerous small punctures.

Comments. The genus *Matus* is restricted to North America. Young (1953*b)* provided a key to adults of North American species. *Matus* larvae have been described (Wolfe and Roughley 1985) and Hilsenhoff (1993*b*: 130) gives a key to the larvae of the two Canadian species.

Key to species of *Matus* of North America
(modified from Young 1953*b)*

1. Small, length 5.4 to 5.9 mm; body short and broad and not attenuate posteriorly; head with punctation very fine; Florida .... *M. leechi* Young 1953*b*

1'. Length 7.0 to 9.5 mm; body more elongate and more or less attenuate posteriorly; head distinctly punctate; widely distributed 2

2(1). Metacoxal plate with fine isodiametric microreticulation; aedeagus in lateral aspect with ventral margin deeply emarginate basally (Fig. 175E) 3

2'. Metacoxal plate with microsculpture obsolete, surface smooth and shiny though sparsely punctate; aedeagus in lateral aspect with ventral margin forming a continuous U-shaped curve from base to apex (Fig. 175H) .... 2. *M. bicarinatus* (Say)

3(2). Aedeagus in lateral aspect with an acute tooth at distal end of basal emargination; body more elongate, widest at about middle of length; Texas and southern Arkansas .... *M. relictus* Young 1953*b*

3'. Aedeagus in lateral aspect with angle between basal emargination and apical ligulate piece obtuse (Fig. 175E); outline broader, point of maximum width behind middle of length; southern Canada to Florida and eastern Texas .... 1. *M. ovatus* Leech

1. *Matus ovatus* Leech 1941
Figs. 174; 175A, C – E

Matus ovatus Leech 1941*c*: 79 – 83. Type locality - Lexington, Massachusetts.

Matus ovatus blatchleyi Leech 1941*c*: 82. Type locality - Brighton, Okeechobee, Florida.

Selected Reference. Young 1953*b*: 53 – 55; Hilsenhoff 1993: 130.

Description. Length = 7.0 to 9.4 mm; width = 3.4 to 4.6 mm; length: width = 2.05 to 2.25. Body ovate (Fig. 174A).

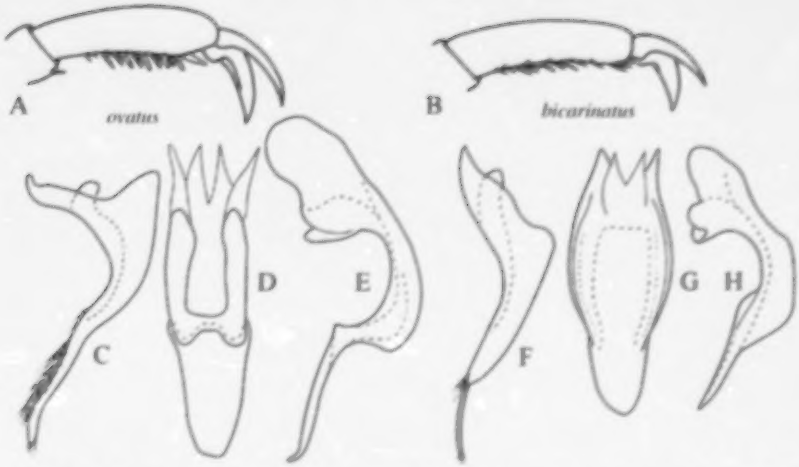


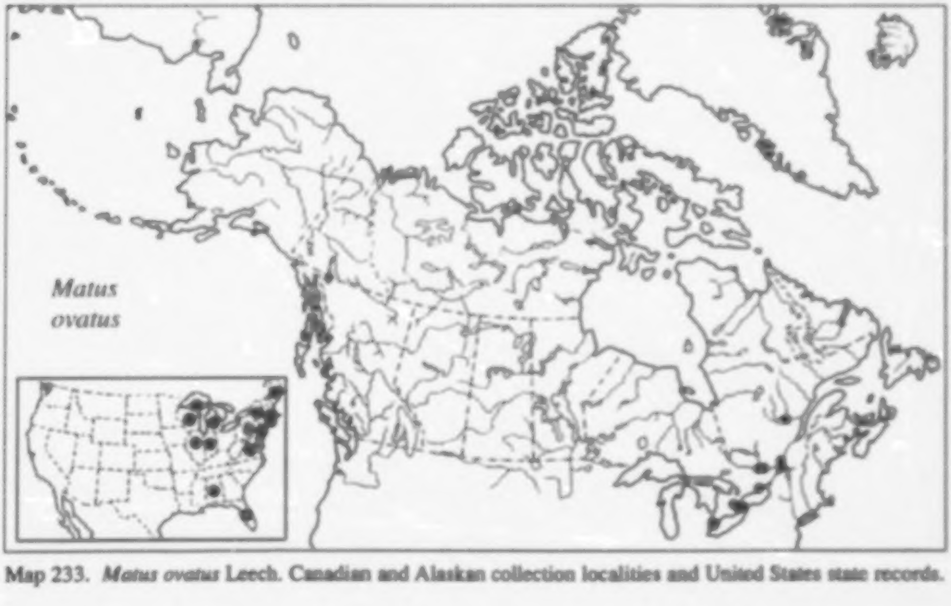
Fig. 175. *Matus*, male. A, B - protarsal claws, posterior. A - *M. ovatus*. B - *M. bicarinatus*. C - E - *M. ovatus*. C - paramere. D - aedeagus, dorsal. E - aedeagus, lateral. F - H - *M. bicarinatus*. F - paramere. G - aedeagus, dorsal. H - aedeagus, lateral.

Color pale brown to reddish brown.

Dorsal surface with fine, rounded isodiametric microreticulation, with numerous small punctures. Metacoxal plate with isodiametric microreticulation visible at 50 times magnification.

Male anterior protarsal claw (Fig. 175A) subequal in length to posterior, broader basally and with an evident basoventral concavity. Aedeagus (Fig. 175D, E) in lateral aspect with ventral margin deeply emarginate basally.

Comments. Leech (1941) described two subspecies, *M. o. ovatus* which occurs in Canada and the northern United States, and *M. o. blatchleyi* from Florida and Georgia to eastern Texas.



Map 233. *Matus ovatus* Leech. Canadian and Alaskan collection localities and United States state records.

Ecology. These insects occur along the margins of rather eutrophic ponds, often amongst *Typha* or decaying deciduous leaves.

Distribution. Map 233. The range of the nominate subspecies extends from southern Ontario and Quebec south to Maryland, Indiana and Illinois.

2. *Matus bicarinatus* (Say 1823)

Fig. 175B, F – H

Colymbetes bicarinatus Say 1823: 98. Type locality - W. Peabody, Massachusetts.

Selected Reference. Leech 1941*c*: 78 – 79; Young 1953*b*: 53 – 55; Hilsenhoff 1993*b*: 130.

Description. Length = 7.7 to 9.3 mm; width = 3.7 to 4.4 mm; length: width = 2.16 to 2.25. Very similar to *M. ovatus*, body on average narrower.

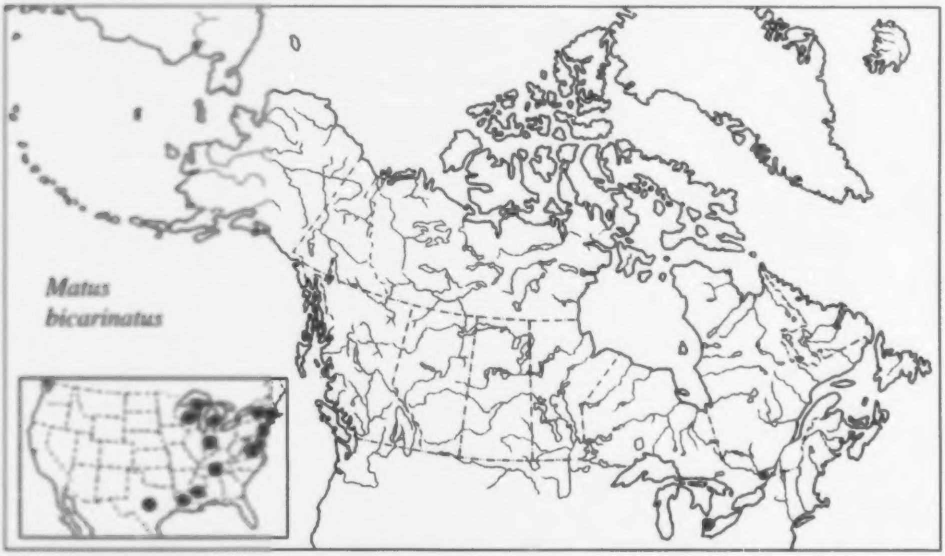
Color pale brown to brownish red, appendages paler.

Sculpture similar to that of *M. ovatus* except metacoxal plates with reticulation obsolete, plate shiny and without detectable meshes at 50 times magnification.

Male protarsal claws (Fig. 175B) slightly shorter than in *M. ovatus*, claws subequal in length, anterior claw broader and with a more prominent basoventral tooth. Paramere and aedeagus as in Fig. 175F – H.

Ecology. Hilsenhoff (1993) collected specimens from permanent ponds and marshes which were near or associated with large streams.

Distribution. Map 234. This species has a wide range in eastern North America, from extreme southern Ontario south to northern Florida and west to Houston, Texas.



Map 234. *Matus bicarinatus* (Say). Canadian and Alaskan collection localities and United States state records.

Tribe Colymbetini Erichson 1837

Diagnosis. Moderate to large size, length = 8.5 to 20.0 mm. Shape various, ovate and somewhat depressed to rather elongate. Color and sculpture various.

Color yellow with various maculation to black. Sculpture various, generally with coarse meshes and finer microreticulation.

Clypeal foveae oval to transverse and widely separated medially. Eye with anterior margin emarginate. Palpi and antenna unmodified. Pronotum with lateral bead well defined or absent. Prosternum and its process more or less in same plane in lateral aspect, not longitudinally grooved medially; process various, short to moderate in length and bluntly pointed apically. Metasternum anteromedially slightly flattened to sharply impressed for reception of prosternal process. Metasternal wing relatively broad. Intralinear space of metacoxae relatively broad, metacoxal lines diverging anteriorly, becoming obsolete or effaced before contacting metasternum. Hind legs slender to moderate in width; metafemur with setae on posteroapical angle but these not arranged in a linear comb; metatibia with dorsal face bearing a row of bifid setae; metatarsomeres 1 to 4 lobed apically; anterior (dorsal) metatarsal claw much shorter than posterior. Male with natatorial setae present on hind margin of metatibia and outer margin of metatarsomeres, these setae absent from female.

Male pro- and mesotarsomeres 1 to 3 narrowly to rather broadly dilated, clothed ventrally with adhesive setae of various size. Genitalia with parameres symmetrical; aedeagus various, generally elongate. Female gonocoxa lightly sclerotized, with short setae.

Comments. This tribe is represented in North America by the cosmopolitan genus *Rhantus* Dejean, the Holarctic genus *Colymbetes* Clairville and by the endemic North American genera *Hoperius* Fall and *Neoscutopterus* Balfour-Browne. These insects are similar to members of the subfamily Dytiscinae in size but generally are less strong swimmers, having slenderer hind legs. They typically occur in areas of dense vegetation at the margins of both temporary and permanent ponds but some species are lotic.

Genus *Neoscutopterus* J. Balfour-Browne 1943
Fig. 176

Meladema: LeConte 1862: 522. Not Laporte 1834.

Scutopterus: Sharp 1882*a*: 606. Not Aubé 1836.

Neoscutopterus Balfour-Browne 1943: 72. Type species - *Agabus angustus* LeConte 1850, by original designation.

Pseudoscutopterus Hatch 1953: 230. Type species - *Agabus angustus* LeConte 1850, by monotypy.

Diagnosis. Size large, and robust (Fig. 176A). Length = 13.5 to 16.7 mm.

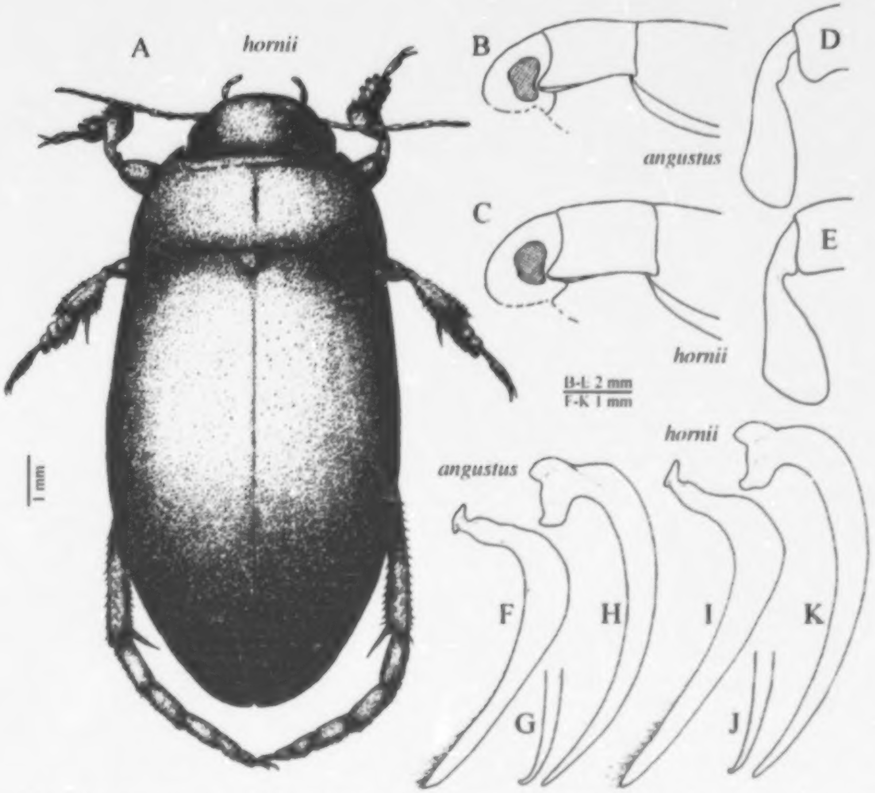


Fig. 176. *Neoscutopterus*. A - *N. hornii* male. B, C - pronotum and elytral base, lateral. B - *N. angustus*. C - *N. Hornii*. D, E - protibia, anterior. D - *N. angustus*. E - *N. hornii*. F - H - *N. angustus*. F - paramere. G - aedeagus apex. H - aedeagus, lateral. I - K - *N. hornii*. I - paramere. J - aedeagus apex. K - aedeagus, lateral.

Body, including legs, predominantly piceous to black; antenna and palpi rufous or infuscate. Elytron with sculpture coarse, consisting of large irregular meshes, microreticulation fine or obsolete.

Pronotum lacking lateral bead; posterolateral angle produced and acute. Elytron with epipleuron visible to humeral angle in lateral aspect. Prosternal process well developed and received into V-shaped anteromedial impression of metasternum. Metasternal wing of moderate width to very broad. Metatarsomeres 1 to 4 apical lobes relatively short and broad.

Male protibia (Fig. 176D, E) emarginate on basoventral margin; protarsomeres 1 to 3 broadly dilated and together bearing four transverse rows of rounded scales beneath. Parameres (Fig. 176F, I) strongly sclerotized, slender, tapering and setose apically; aedeagus (Fig. 176G, H, J, K) long and slender, apex twisted to right and with a small, sharp apical hook.

Comments. These insects are typically found in cold water shaded by *Carex* and with sphagnum moss. Little is known of their ecology and behaviour and they are seldom collected unless a special effort is made. The most successful active collecting technique consists of repeatedly compressing mosses and *Carex* stems in and adjacent to small bog pools and boggy streams and sweeping the disturbed area with a stout dip-net. Beetles are not usually encountered the first few times an area is swept and it appears as though they have to be pushed out of the vegetation or dislodged before they can be removed. Specimens of *N. hornii* have been found in pit-fall traps set in bogs indicating they leave the water at times and crawl over the moss mat (H. Goulet, pers. com.). Hilsenhoff (1987) has found bottle traps to be much more effective than sweep-net collecting for adult specimens and has also collected larvae in bottle traps (Hilsenhoff 1989). Hilsenhoff (1989) has described the larva and provided a larval key to species (Hilsenhoff 1993*b*). Hilsenhoff (1993*b*), on the basis of collection records of adults and larvae in Wisconsin, suggests the insects are semivoltine with at least one winter, and perhaps two, spent in a larval stage. Adults also overwinter.

Key to species of *Neoscutopterus*

1. Antenna with antennomeres 3 to 11 infuscate; palpi each with apical palpomere infuscate; abdomen black without rufous spots; metasternal wing broad, width of metacoxa: width of metasternal wing = 2.6 to 3.6 .... 1. *N. angustus* (LeConte)

1'. Antenna and palpi entirely rufous or at most lightly infuscate apically; abdomen black except sterna 2 and 3 rufous mediolaterally; metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.6 to 4.4 .... 2. *N. hornii* (Crotch)

1. *Neoscutopterus angustus* (LeConte 1850)

Fig. 176B, D, F – H

Agabus angustus LeConte 1850: 213. Type locality - not given, probably vicinity of Lake Superior.

Selected References. Larson 1975: 385; Hilsenhoff 1989: 195 – 202; Hilsenhoff 1993*b*: 131; Larson 1997*b*: 512.

Description. Length = 13.6 to 15.6 mm; width = 6.6 to 7.4 mm; length: width = 1.96 to 2.19 Body elongate, somewhat depressed.

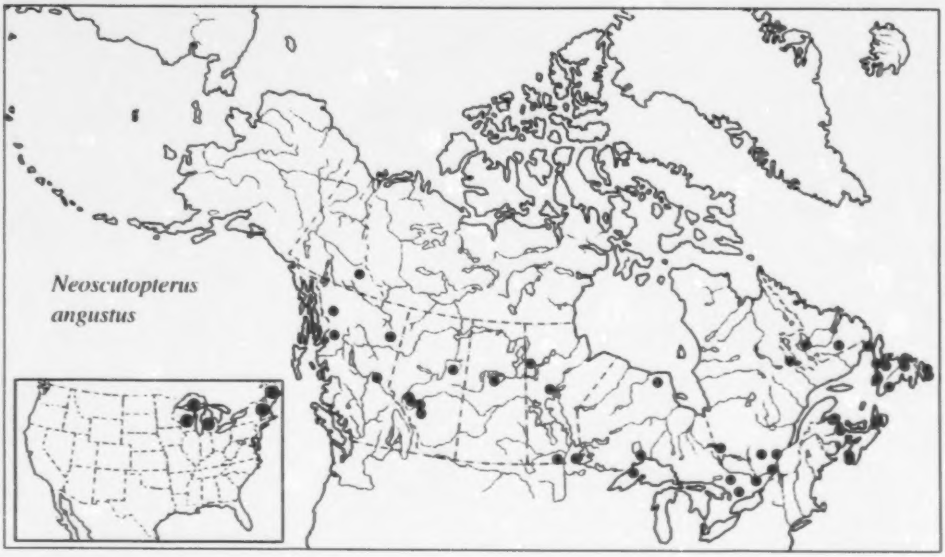
Color mainly black. Antenna rufous basally, antennomeres 3 to 11 lightly to darky infuscate; palpi pale basally, apical palpomere piceous. Abdominal sterna without reddish spots on mediolateral portions of sterna 2 and 3.

Pronotum (Fig. 176B) in lateral aspect with lateral margin curved downwards near posterolateral angle. Metasternal wing broad, width of metacoxa: width of metasternal wing = 2.67 to 3.55.

Male protibia (Fig. 176D) with inner basal emargination shallow; tibia slenderer than that of *N. hornii*. Aedeagus and paramere as in Fig. 176F - H.

Ecology. These beetles usually occur in sites where there is slow water flow such as in pools along small streams draining bogs or fens or where there is discernable water movement and channels through sphagnum mats.

Distribution. Map 235. The range extends from Newfoundland to northern British Columbia and the southern Yukon Territory. Although not commonly collected anywhere, specimens are most frequently encountered in the eastern part of the range.



Map 235. *Neoscutopterus angustus* (LeConte). Canadian and Alaskan collection localities and United States state records.

2. *Neoscutopterus hornii* (Crotch 1873)
Fig. 176A, C, E, I – K

Scutopterus hornii Crotch 1873: 405. Type locality - Canada.

Selected References. Larson 1975: 385; Hilsenhoff 1993*b*: 131 – 132; Larson 1997*b*: 512 – 513.

Description. Length = 13.7 to 16.7 mm; width = 7.0 to 8.3 mm; length: width = 1.87 to 2.04. Similar to *N. angustus* but slightly larger on average, body (Fig. 176A) more robust, more strongly convex dorsally and more rounded laterally.

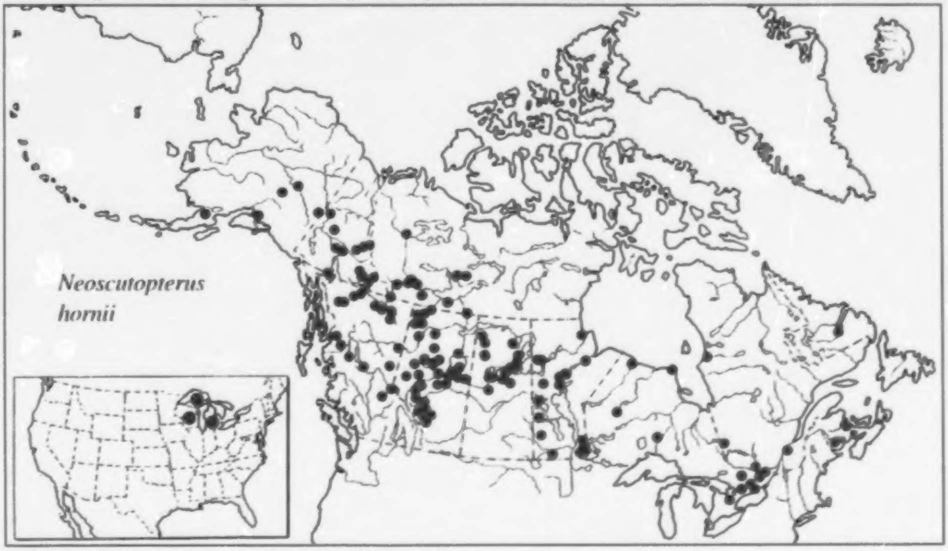
Color mainly black. Antenna and palpi entirely rufous or at most lightly infuscate apically. Abdominal sterna 2 and 3 rufous mediolaterally (most evident on live specimens).

Pronotum (Fig. 176C) in lateral aspect with lateral margin forming a slight but even curve throughout its length. Metasternal wing narrower than in *N. angustus*, width of metacoxa: width of metasternum = 3.68 to 4.37.

Male protibia (Fig. 176E) strongly dilated distally, mesobasal emargination strong. Male genitalia as in Fig. 176I - K.

Ecology. These insects occur in small, mossy pools either in bog or fen sites or in the moss mat along the margins of lakes and beaver ponds. They do not have any apparent requirement for flowing water although some specimens have been collected from the edges of boggy streams.

Distribution. Map 236. The range is transcontinental, from Labrador and New Brunswick to northwestern British Columbia and Alaska. The species is common in the western part of its range but only infrequently collected east of the Great Plains.


Neoscutopterus hornii

Map 236. *Neoscutopterus hornii* (Crotch). Canadian and Alaskan collection localities and United States state records.

Genus *Rhantus* Dejean 1833
Figs. 177; 178; 179

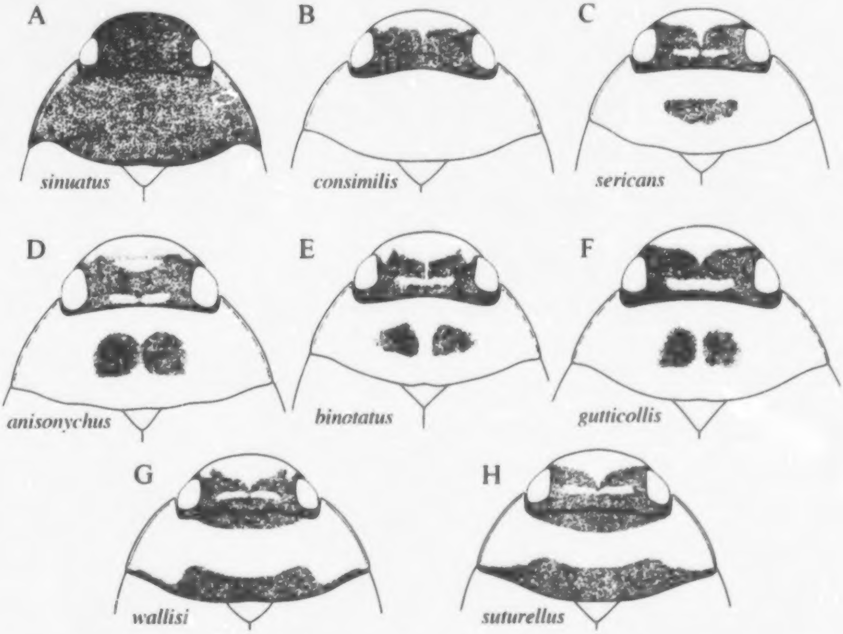

A
sinuatus
B
consimilis
C
sericans
D
anisonychus
E
binotatus
F
gutticollis
G
wallisi
H
suturellus

Fig. 177. ***Rhantus***, **color pattern of head and pronotum. A - *R. sinuatus*. B - *R. consimilis*. C - *R. sericans*. D - *R. anisonychus*. E - *R. binotatus*. F - *R. gutticollis*. G - *R. wallisi*. H - *R. suturellus*.**

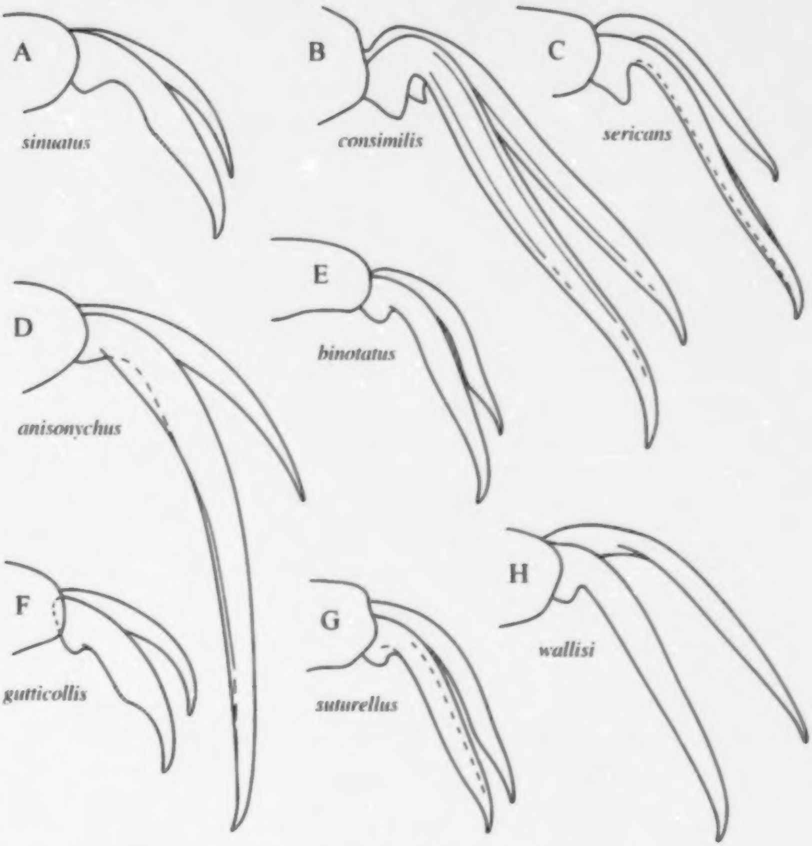


Fig. 178. *Rhantus*, male protarsal claws, anterior. A - *R. sinuatus*. B - *R. consimilis*. C - *R. sericans*. D - *R. anisonychus*. E - *R. binotatus*. F - *R. gutticollis*. G - *R. suturellus*. H - *R. wallisi*.

Rhantus Dejean 1833: 54. Type species - *Colymbetes pulverosus* Stephens, designated by Hope 1839.

Nartus Zaitzev 1907: 103. Type species - *Dytiscus grapii* Gyllenhal, by monotypy.

Diagnosis. Size moderate to large, length = 8.5 to 16.0 mm; shape, lateral margin of body evenly rounded and pronotum and elytra continuous in dorsal outline; dorsoventrally flattened.

Color various, dorsal surface ranging from yellow-brown with various irrorations and maculations to entirely black. Sculpture various, basically with fine lines forming small irregular meshes; meshes with fine microreticulation; finely punctate. Some females with elytron coarsely roughened.

Pronotum with lateral bead clearly delimited or not; hind margin slightly to strongly arcuate laterally, posterolateral angle produced or not. Elytron in lateral aspect with epipleuron disappearing behind lateral margin posterad of shoulder. Prosternal process convex to subcarinate medially, of moderate length, apex pointed but not

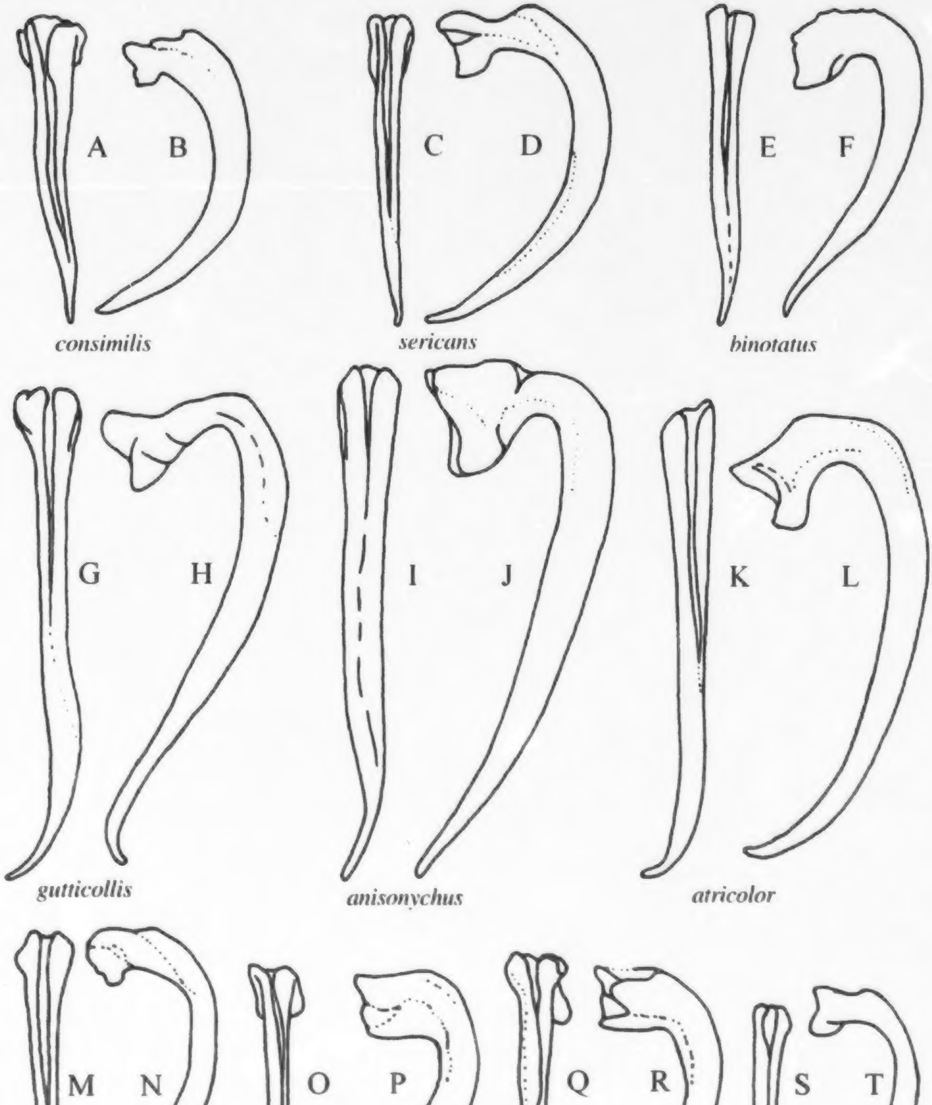

A
B
consimilis
C
D
sericans
E
F
binotatus
G
H
gutticollis
I
J
anisonychus
K
L
atricolor
M
N
sinuatus
O
P
suturellus
Q
R
wallisi
S
T
calidus

Fig. 179. *Rhantus*, aedeagus dorsal and lateral. A, B - *R. consimilis*. C, D - *R. sericans*. E, F - *R. binotatus*. G, H - *R. gutticollis*. I, J - *R. anisonychus*. K, L - *R. atricolor*. M, N - *R. sinuatus*. O, P - *R. suturellus*. Q, R - *R. wallisi*. S, T - *R. calidus* (from Zimmerman and R. Smith 1975).

acuminate. Metasternum with anteromedial impression deeply impressed for reception of prosternal process, extending posteriorly to level of hind margin of mesocoxae. Metasternal wings of various width. Metatarsomeres lobed apically; metatarsal claws unequal, posterior claw about one-half length of anterior.

Male protarsomeres 1 to 3 slightly to moderately dilated, together bearing 4 transverse rows of elongate scales on ventral surface; protarsal claws (Fig. 178) variously modified. Genitalia with parameres symmetrical, broadest basally, tapered towards apex, setose along mesal face; aedeagus (Fig. 179) simple. Female gonocoxa short, lightly sclerotized, setose apically.

Comments. This large genus is represented in all major zoogeographic regions and on many oceanic islands. Within the Holarctic region, two subgenera are represented: *Nartus* Zaitzev with the Palaearctic *R. grapii* (Gyllenhal) and the Nearctic *R. sinuatus*; and *Rhantus* s. str. The species of *Nartus* are characterized by body mainly black, pronotum with posterolateral angles strongly produced (Fig. 177A) and labrum shallowly emarginate medially. Members of *Rhantus* are various in color but most are pale with distinct dorsal maculation, pronotum with posterolateral angles less produced (Fig. 177B – H) and labrum more deeply emarginate medially. The ten North American species of *Rhantus* have been revised by Zimmerman and R. Smith (1975). Several of these species have also been discussed by Balke (1990, 1993).

The various species together occur across almost the entire range of habitats occupied by dytiscids, ranging from cold acidic bogs, to marshes and temporary, even saline, ponds. Certain species are mainly lotic, occurring in springs or at the edges of small streams. Most species are apparently univoltine with adults overwintering. The larvae of several species have been described but Hilsenhoff (1993*b)* discussed the problems involved in separating the species.

Key to species of *Rhantus* of North America
(modified from Zimmerman and R. Smith 1975)

1. Pronotum with hind margin strongly arcuate on each side, posterolateral angle produced and acute (Fig. 177A); body almost entirely black; length = 9.0 to 11.0 mm (subgenus *Nartus*) .... 1. *R. sinuatus* (LeConte)

1'. Pronotum with hind margin not or only slightly arcuate laterally, posterolateral angle broader and not produced posteriorly (Fig. 177B – H); color and size various but if body largely black, length greater than 14 mm (subgenus *Rhantus*) 2

2(1). Large species, 10 to 16 mm; pronotum entirely black, or dark medially with pale lateral margins (not in Canada or Alaska) 3

2'. Smaller species, length = 8.5 to 13 mm; pronotum color various but largely pale, darker maculations may occur along anterior and posterior margins or as one or two medial spots on disc 4

3(2). Color almost entirely black; southwestern United States and Mexico; length = 14.0 to 16.6 mm .... *R. atricolor* (Aubé 1838*b*)

3'. Pronotum dark medially with broad pale lateral margins; elytron variegated; ventral surface dark reddish brown; length = 10.1 to 14.3 mm; southern United States, Central and South America .... *R. calidus* (Fabricius 1792)

4(2). Head dorsally with posterior half entirely black, without frontal spots (Fig. 177B); ventral surface of body entirely pale to dark reddish brown . . . . .2. *R. consimilis* Motschulsky

4'. Head with pale frontal spots or bar (Fig. 177C – H); color of ventral surface various, with at least some black maculation 5

5(4). Head with a more or less enclosed pale transverse band or triangularly shaped spot anterad to frontal spots; pronotum with a pair of discal spots or spots fused to produce a single transverse medial band (Fig 177D); ventral surface including epipleuron mainly piceous to black; western United States and Mexico . . . .*R. anisonychus* Crotch 1873

5'. Head without an enclosed or partly enclosed pale spot anterad to frontal spots; pronotum variously maculate; ventral surface of most specimens with evident pale markings, epipleuron pale 6

6(5). Pronotum with one or two spots on middle of disc (Fig. 177C, E, F) . . . 7

6'. Pronotum with dark markings along anterior and posterior margins, disc immaculate medially or darkened through expansion of dark marginal bands (Fig. 177G, H) 9

7(6). Pronotal disc with a pair of medial spots (Fig. 177E, F); elytron with lateral margin, beginning at level of sternum 1, dark brown or piceous (at least visible along under surface); male protarsal claws shorter, posterior claw not less than three-quarters length of anterior; male protarsomere 5 ventrally with a pair of parallel longitudinal rows of setae 8

7'. Pronotum with a single medial transverse band (this band broken medially on some specimens to form a pair of spots) (Fig. 177C); elytron with lateral margin entirely pale, unpigmented; male protarsal claws (Fig. 178C) very elongate, posterior claw about two-thirds length of anterior; male protarsomere 5 with ventral setae not forming two parallel rows, with a large basal patch and two short distal rows . . . . .3. *R. sericans* Sharp

8(7). Dark color of head not extending anteriorly around front of eye (Fig. 177E); male protarsal claws more elongate, anterior claw at least three-quarters length of protarsomere 5 (Fig. 178E); transcontinental . . . . 4. *R. binotatus* Harris

8'. Dark color of head narrowly extending around front of eye (Fig. 177F); male protarsal claws shorter, anterior claw about two-thirds length of protarsomere 5 (Fig. 178F); Cordillera and Great Plains, east to Wisconsin . . . . 5. *R. gutticollis* (Say)

9(6). Pronotum with basomedial piceous markings truncate laterally, not or only narrowly extended to posterolateral angle (Fig. 177G); metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.40 to 4.25; male anterior protarsal claw one and one-quarter or more length of protarsomere 5, anterior claw distinctly longer than posterior (Fig. 178H); most females with basolateral half of elytron with coarse, deeply impressed sculpture . . . . .6. *R. wallisi* Hatch

9'. Pronotum with basal piceous marking broader, not abruptly narrowed laterally and continued onto posterolateral angle (Fig. 177H); metasternal wing broad, width of metacoxa: width of metasternal wing = 3.00 to 3.55; male anterior protarsal claw less than one and one-quarter length of protarsomere 5; protarsal claws subequal in length (Fig. 178G); most females without coarse elytral sculpture, or sculpture restricted to medial sublateral portion of disc . . . . 7. *R. suturellus* Harris

1. *Rhantus sinuatus* (LeConte 1862)

Figs. 177A; 178A; 179M, N

Colymbetes sinuatus LeConte 1862: 522. Type locality - "Dacotah".

Selected References. Larson 1975: 379; Zimmerman and R. Smith 1975: 105 – 108; Hilsenhoff 1993*b*: 134 – 135.

Description. Length = 9.2 to 10.9 mm; width = 4.5 to 5.1 mm; length: width = 1.92 to 2.02. Body relatively elongate.

Color (Fig. 177A) mainly piceous to black except anterior margin of head and lateral margins of pronotum and elytra paler, rufous to piceous gradually darkened onto disc. Head without frontal spots or bar; antenna and palpi rufous. Legs dark rufous.

Sculpture fine, consisting of small, irregular meshes on dorsal surface of body, meshes smaller and more or less granulate on elytron. Sculpture similar on both sexes.

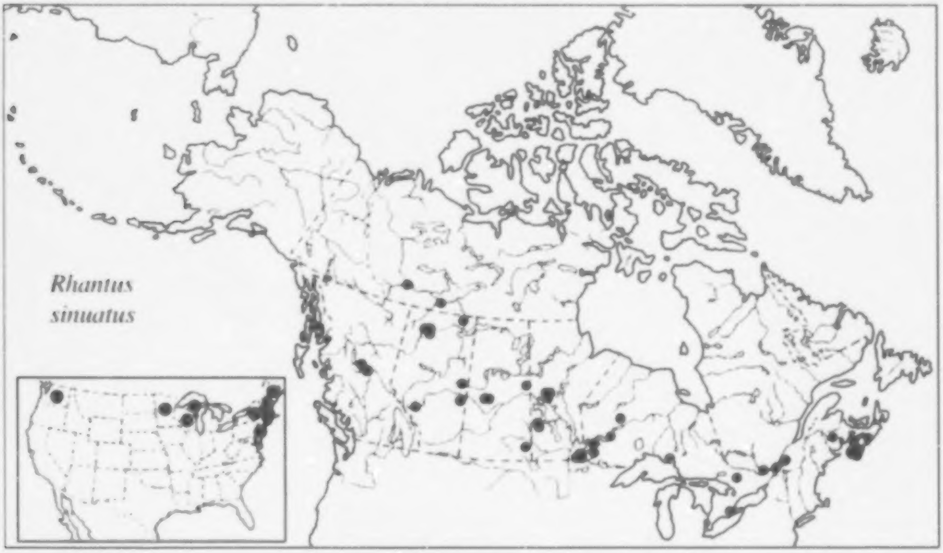
Pronotum (Fig. 177A) with basal margin strongly sinuate, posterolateral angle acutely produced; lateral bead well defined except on anterolateral angle. Prosternal process smoothly convex in cross-section. Metasternal wing narrow, width of metacoxa: width of metasternal wing = 3.7 to 4.9.

Male protarsomere 5 ventrally with a pair of parallel longitudinal rows of stout setae; protarsal claws (Fig. 178A) little modified, anterior claw slightly longer than posterior, broadened medially, with a subbasal ventral emargination. Mesotarsus with anterior claw very broad, little arcuate; posterior claw shorter, narrower and more strongly arcuate. Aedeagus (Fig. 179M, N) short, slender, more or less evenly arcuate apically in lateral aspect, apex not curved in dorsal aspect; paramere slightly curved, narrowed apically.

Comments. This species is often mistaken for a species of *Agabus*, especially *A. erichsoni* with which it frequently co-occurs.

Ecology. These beetles occur in lentic habitats densely overgrown with emergent vegetation. The species is common in bogs in Nova Scotia, but it also occurs in habitats with dense sedges, rushes or *Typha*. Perhaps, because of occurring in dense vegetation, the species is poorly collected with conventional techniques but specimens have been taken in numbers in bottle traps (Aiken and Roughley 1985).

Distribution. Map 237. Transcontinental or almost so in the boreal zone, from Nova Scotia to at least north-central British Columbia.



Map 237. *Rhantus sinuatus* (LeConte). Canadian and Alaskan collection localities and United States state records.

2. *Rhantus consimilis* Motschoulsky 1859

Figs. 177B; 178B; 179A, B

Rhantus consimilis Motschoulsky 1859: 168. Type locality - San Francisco, California.

Selected References. Larson 1975: 380; Zimmerman and R. Smith 1975: 81 – 87; Hilsenhoff 1993*b*: 134.

Description. Length = 9.2 to 11.6 mm; width = 4.8 to 5.3 mm; length: width = 1.84 to 1.95.

Head pale anteriorly, frons and hind margin black, without pale frontal spots (Fig. 177B). Pronotum of most specimens rufous, immaculate, or some specimens with a small piceous, medial spot; some specimens with anterior and posterior margins diffusely darkened. Elytron testaceous with black irrorations, female with impressed lines largely black; lateral margin infuscate along apical half (visible at least on ventral surface); lateral bead and epipleuron pale. Ventral surface pale to dark reddish.

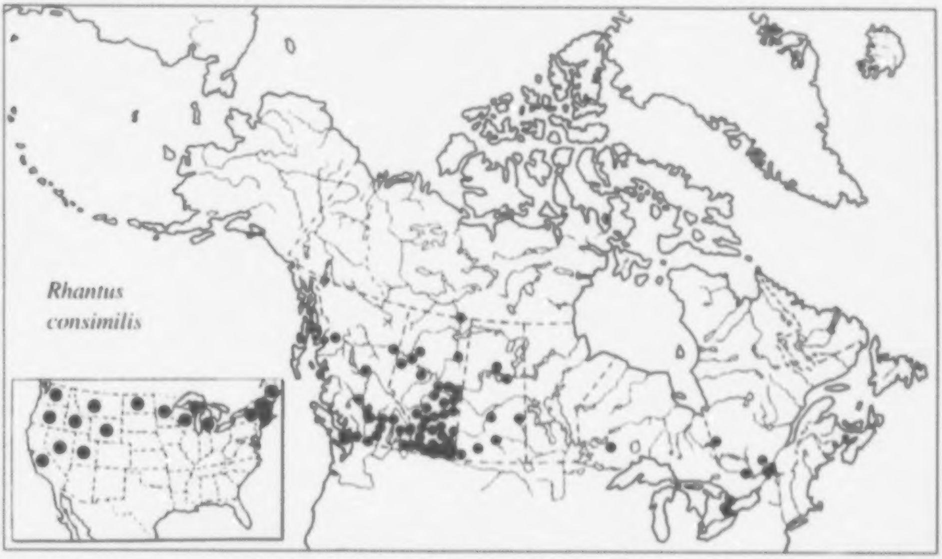
Sculpture of male elytron consisting of irregular, elongate meshes, more irregular in shape apically; with fine secondary microreticulation. Female with sculpture similar but basal two thirds to three quarters of disc with coarse longitudinal lines.

Pronotum with hind margin nor or only faintly arcuate laterally, hind angles broadly rounded and obtuse. Prosternum tectiform in cross-section. Metasternal wings narrow, width of metacoxa: width of metasternal wing = 3.60 to 4.40.

Male protarsomere 5 ventrally with two parallel, longitudinal rows of medially converging stout setae; protarsal claws (Fig. 178B) elongate, similar in shape but anterior slightly longer than posterior and both distinctly longer than protarsomere 5. Mesotarsus with posterior claw shorter than anterior and strongly hooked apically. Aedeagus (Fig. 179A, B) slender, evenly arcuate.

Ecology. These beetles occur in warm, weedy ponds, generally in open grassland areas. They have been collected from both permanent and temporary habitats.

Distribution. Map 238. The range is transcontinental at the latitude of southern Canada and the northern half of the United States.



Map 238. *Rhantus consimilis* Motschulsky. Canadian and Alaskan collection localities and United States state records.

3. *Rhantus sericans* Sharp 1882

Figs. 177C; 178C; 179C, D

Rhantus sericans Sharp 1882*a*: 619. Type locality - British Columbia.

Selected References. Larson 1975: 383 – 384 (as *R. frontalis*); Zimmerman and R. Smith 1975: 74 – 81 (*R. frontalis*); Balke 1990: 206 – 207; Hilsenhoff 1993*b*: 134; Larson 1997*b*: 513.

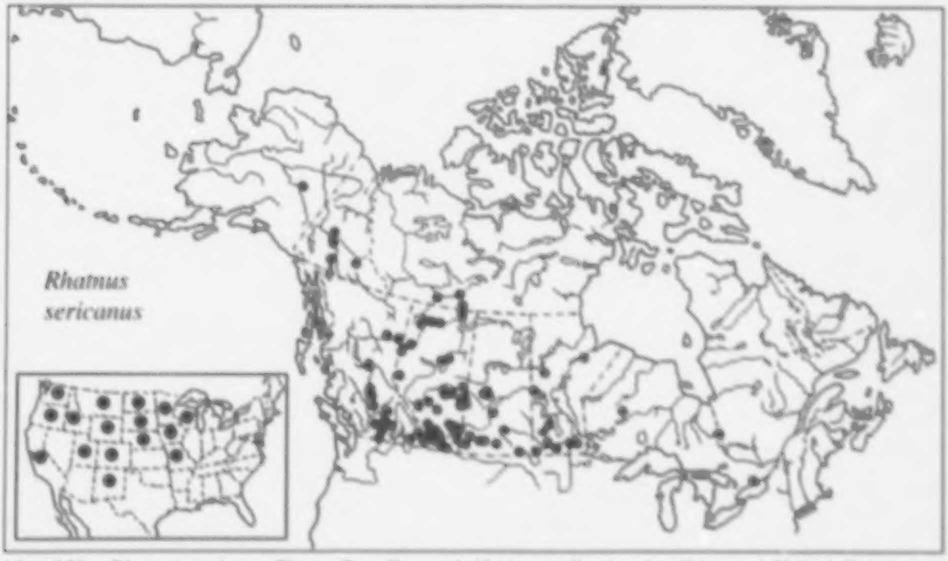
Description. Length = 8.6 to 10.8 mm; width = 4.3 to 5.3 mm; length: width = 1.84 to 2.00.

Head dorsally black except frontal spots (or bar), frons anteromedially and clypeus, pale (Fig. 177C). Pronotum yellow with anterior and posterior margins narrowly piceous medially; disc with a transverse median spot, this spot often appearing bilobed, some specimens from Ontario and Quebec with spot reduced to two small spots or absent; live specimens with a diffuse spot (muscle scar) each side of medial spot. Elytron testaceous, disc irrorate with piceous spots, spots larger and variously confluent towards apex; most specimens with three narrow longitudinal pale stripes each following a row of serial punctures, and a short diagonal stripe more or less parallel to sutural margin; lateral margin and epipleuron pale; lateral bead infuscate on apical half. Ventral surface of body black except prosternum, anterior two thirds of proepisternum and metacoxal processes, pale; abdomen color various, male rufopiceous to piceous except some specimens with posterior margin of each sternite testaceous; female with sterna testaceous except sterna 2 to 5 each with a piceous basolateral spot on each side.

Sculpture sexually dimorphic. Male elytron with very irregular meshes; somewhat longitudinal basally, more irregular apically; interspaces with fine granulate secondary sculpture. Female with sculpture similar but basomedially at least with a few deep longitudinal grooves, most specimens with these grooves numerous and more or less confluent.

Pronotum with base only slightly sinuate laterally, posterolateral angle obtuse; lateral bead discontinuous near anterolateral angle. Prosternal process tectiform in cross section. Metasternal wing moderately narrow, width of metacoxa: width of metasternal wing = 3.3 to 3.9.

Male protarsomere 5 ventrally with a prominent basal group of large stiff setae, distally with a row of setae parallelling anterior margin and a short row of converging setae parallelling hind margin; protarsal claws (Fig. 178C) very elongate, anterior claw 1.35 to 1.5 times length protarsomere 5 and about one third longer than posterior claw. Mesotarsus with anterior claw slender, shallowly and evenly arcuate; posterior claw about half length of anterior, with apex strongly arcuate. Aedeagus (Fig. 179C, D) slender, more or less evenly arcuate in lateral aspect, with apex very slightly deflected to right in dorsal aspect.



Map 239. *Rhantus sericans* Sharp. Canadian and Alaskan collection localities and United States state records.

Ecology. This is a very common species in grassland and parkland regions of western Canada. The beetles occur in many types of lentic habitats but are most frequently found in rich, open, sun-warmed ponds. They occur in both fresh and distinctly saline waters. The beetles fly readily, often during the day, and are likely to appear in almost any water body and thus are among the first dytiscids to colonize newly formed ponds.

Distribution. Map 239. This is primarily a western species, being common throughout much of the continent west of the eastern boundary of the Great Plains. However, there are a few records from southern Ontario and Quebec. It is possible that these most easterly records represent recent colonization of the area as vegetation has been changed by man from closed forest to grassland (Lindroth 1971).

4. *Rhantus binotatus* (Harris 1828)

Figs. 177E; 178E; 179E, F

Colymbetes binotatus Harris 1828*b*: 164. Type locality - not given.

Selected References. Larson 1975: 382 – 383; Zimmerman and R. Smith 1975: 58 – 68; Hilsenhoff 1993*b*: 133; Larson 1997*b*: 513.

Description. Length = 9.6 to 11.8 mm; width = 4.9 to 5.7 mm; length: width = 1.87 to 2.00. Very similar to *R. gutticollis* but smaller, head color different, and male protarsi and genitalia differing.

Head black posteriorly, frontal bar, anterior half of frons and clypeus yellow, yellow area contacting anterior margin of eye near emargination (Fig. 177E). Pronotum yellow with a pair of somewhat quadrate medial spots. Elytron yellow with darker irrorations, on many specimens these fused along line of serial punctures to form three longitudinal series of spots and a subapical crescentic spot; lateral margin, beginning at level of sternum 1, brown or piceous (may be visible only on under surface); epipleuron pale. Ventral surface of body mainly black with the following structures testaceous to rufous; prosternum and its process, anterior portion of proepisternum, metacoxal processes and abdominal sterna laterally and apically.

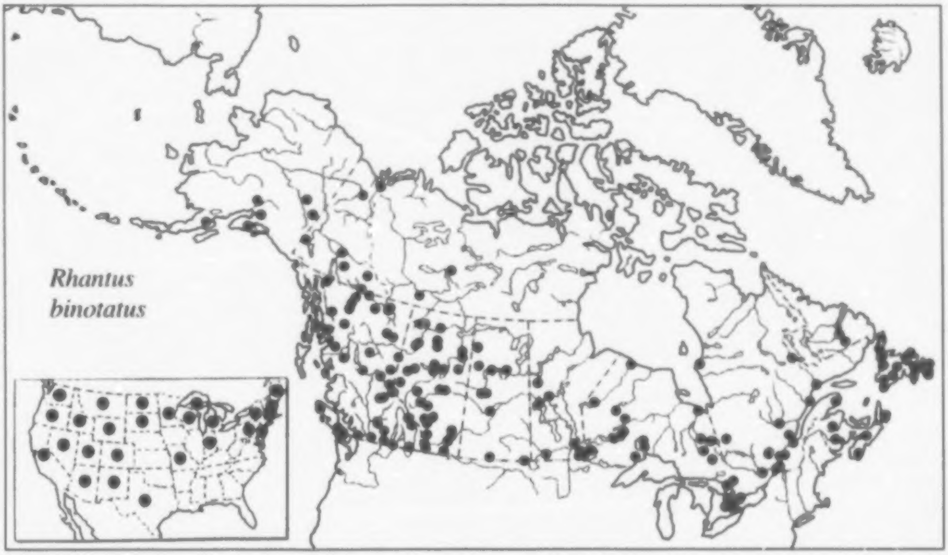
Sculpture similar on both sexes; elytron with small irregular meshes, small punctures present both in lines and on some meshes, microreticulation present but largely effaced basomedially.

Pronotum with hind margin slightly sinuate, hind angles very slightly produced, acute but apically rounded. Prosternum strongly convex but rounded in cross-section. Metasternal wings relatively broad, width of metacoxa: width of metasternal wing = 2.55 to 3.30.

Male protarsomere 5 ventrally with two parallel longitudinal rows of stiff setae; anterior protarsal claw (Fig. 178E) slightly shorter than protarsomere 5, anterior claw longer and broader than posterior, both slightly sinuate ventrally. Aedeagus (Fig. 179E, F) short, in lateral aspect apex very slightly deflected, in dorsal aspect apex bent slightly to right.

Ecology. This is primarily a species of seeps, springs and small streams, but as specimens are very prone to fly, individuals appear in almost all types of aquatic habitats. Daytime flight in the spring has been observed many times in Newfoundland

Distribution. Map 240. This species is widely distributed throughout Canada south of the arctic. In the western United States, it occurs south along the mountains to California, Arizona and New Mexico. In the east, the southern limits are primarily the Great Lakes and New England States.



Map 240. *Rhantus binotatus* (Harris). Canadian and Alaskan collection localities and United States state records.

5. *Rhantus gutticollis* (Say 1834)

Figs. 177F; 178F; 179G, H

Colymbetes gutticollis Say 1834: 442. Type locality - Las Vigas, Veracruz, Mexico.

Selected References. Zimmerman and R. Smith 1975: 42 – 58; Zimmerman and Ludwig 1975: 63 – 71; Hilsenhoff 1993*b*: 134.

Description. Length = 9.8 to 12.7 mm; width = 4.9 to 6.5 mm; length: width = 1.87 to 2.00.

Head dorsally black on basal half except frontal bar which may be isolated or narrowly contiguous with pale anterior area medially; black area extending completely around anterior margin of eye (Fig. 177F). Pronotum yellow with a pair of oval medial spots. Elytron yellow with dark irrorations, on many specimens irrorations expanded to form three longitudinal series of spots along lines of serial punctures and an indistinct subapical spot; lateral margin, beginning at level of sternum 1, with a longitudinal dark brown to piceous stripe (on some specimens this stripe visible only on underside of elytron) (some specimens from southwestern United States and Central America with elytral irrorations fused and disc predominantly black); epipleuron pale. Ventral surface mainly black except prosternum and process (at least basally), proepisternum and anterior half of proepimeron, metacoxal processes, and lateral margins of abdominal sterna, yellow.

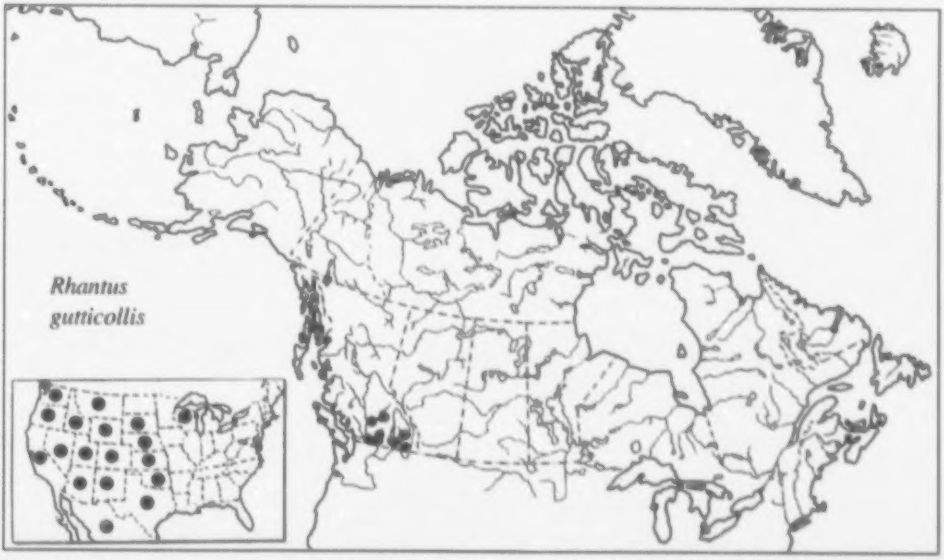
Elytron with meshes small, rounded to elongate but of varied size and shape; microreticulation present or variously effaced. Sculpture similar on both sexes.

Pronotum with hind margin shortly arcuate laterally, posterolateral angles acute and somewhat produced. Prosternal process strongly convex but narrowly rounded medially in cross-section. Metasternal wings moderately narrow, width of metacoxa: width of metasternal wing = 3.18 to 3.75.

Male with protarsomere 5 ventrally bearing two longitudinal rows of stout setae; protarsal claws (Fig. 178F) short, anterior claw less than two-thirds length of protarsomere 5; anterior claw slightly longer and broader than posterior, slightly to distinctly sinuate ventrally. Aedeagus (Fig. 179G, H) elongate, apex produced and strongly curved away from main axis of shaft in both dorsal and lateral aspects.

Ecology. These insects occur in quiet areas of small, clear streams. They are found both amongst vegetation and plant detritus as well as on mineral substrates. However, in Wisconsin Hilsenhoff (1993*b)* considers it to be a lentic species breeding in a cattail and bur-reed pond.

Distribution. Map 241. This is one of the more common water beetles in the western half of the continent. The range extends from southern British Columbia into Central America, and east into the Black Hills, South Dakota and Wisconsin. Zimmerman and R. Smith (1975) recorded specimens (collected in 1927 and 1928 by O. Bryant) from southwestern Alberta but we have not been able to confirm these records with modern collections even though this area has been intensively collected.



Map 241. *Rhantus gutticollis* (Say). Canadian and Alaskan collection localities and United States state records.

6. ***Rhantus wallisi*** **Hatch 1953**

Figs. 177G; 178H; 179Q, R

Rhantus wallisi Hatch 1953: 233. Type locality - Linneus, 8 mi S Houlton, Aroostook Co., Maine.

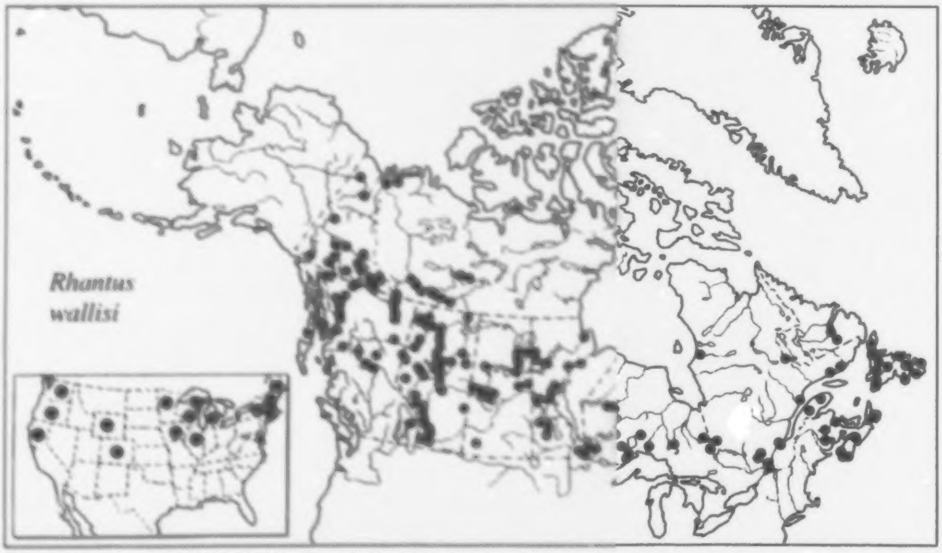
Selected References. Larson 1975: 380 – 381; Zimmerman and R. Smith 1975: 87 – 93; Hilsenhoff 1993*b*: 135; Larson 1997*b*: 513.

Description. Length = 9.4 to 11.6 mm; width = 5.0 to 5.5 mm; length: width = 1.79 to 1.91.

Head dorsally black except frontal spots or bar, frons anteriorly and clypeus, pale (Fig. 177G). Pronotum rufous laterally and medially, anterior margin along medial emargination narrowly piceous to black; posterior margin narrowly black laterally, dark area rather strongly expanded medially. Elytron testaceous, irrorate with dark spots, spots larger and somewhat contiguous apically; lateral bead piceous. Ventral surface mainly black except prosternum and usually its process, proepisternum, and metacoxal processes, yellow to rufous.

Elytron with small meshes of very irregular shape; meshes smooth or with evident microreticulation. Female elytron basally with lines of sculpture deeply impressed, meshes coarse and convex; coarsely sculptured area longitudinally interrupted by several areas of normal sculpture.

Pronotum with hind margin not arcuate laterally, posterolateral angles blunt. Prosternal process subtectiform, strongly convex but narrowly rounded medially. Metasternal wing relatively narrow, width of metacoxa: width of metasternal wing = 3.40 to 4.25.



Map 242. *Rhantus wallisi* Hatch. Canadian and Alaskan collection localities and United States state records.

Male anterior protarsal claw (Fig. 178H)1.26 to 1.43 times as long as protarsomere 5; anterior claw distinctly longer than posterior claw, broader and more or less broadened along ventral margin at base, ventral margin slightly sinuate. Aedeagus (Fig. 179Q, R) more or less evenly curved in lateral aspect.

Ecology. This species occurs in ponds in either wooded areas or adjacent to wooded areas. The beetles are generally in the vegetation-rich margins in sun-warmed areas.

Distribution. Map 242. The species occurs throughout the boreal region of North America, and south in the west along the mountains to northern Colorado and California.

7. *Rhantus suturellus* (Harris 1828)

Figs. 177H; 178G; 179O, P

Colymbetes suturellus Harris 1828*b*: 164. Type locality - not given.

Selected References. Larson 1975: 381 – 382; Zimmerman and R. Smith 1975: 93 – 100; Hilsenhoff 1993*b*: 135; Nilsson and Holmen 1995: 138 – 139; Larson 1997*b*: 513.

Description. Length = 9.4 to 11.1 mm; width = 5.1 to 5.5 mm; length: width = 1.81 to 1.94.

Color very similar to *R. wallisi* differing primarily in the width of the basal black margin of the pronotum (Fig. 177H), this broader medially and not so strongly narrowed sublaterally so that basal margin is relatively broadly black even to lateral angle, some specimens with dark anterior and posterior marginal bands expanded medially and contiguous across disc; lateral bead piceous.

Sculpture similar to that of *R. wallisi* except area of coarse sculpture on female more limited, on basal half of disc or even absent on some specimens.

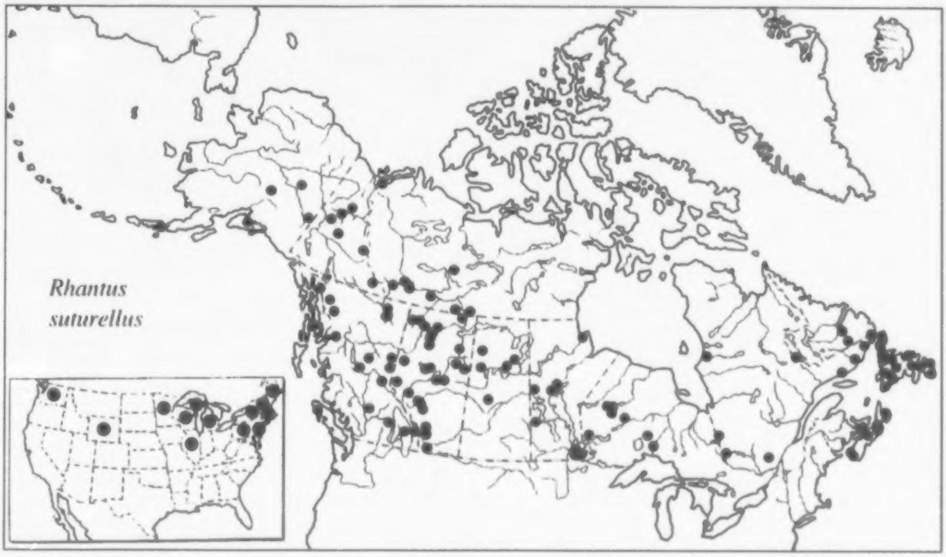
Prosternal process subtectiform, narrowly rounded medially. Metasternal wing relatively broad, width of metacoxa: width of metasternal wing = 3.00 to 3.55.

Male protarsal claws (Fig. 178G) short, anterior claw 1.07 to 1.21 length of protarsomere 5; protarsal claws subequal in length, posterior slightly narrower than anterior, anterior more or less equal in width throughout middle portion of length. Aedeagus (Fig. 179O, P) short, slightly broader in lateral aspect than in *R. wallisi*.

Comments. Nilsson and Holmen (1995) discuss problems in the recognition and nomenclature of this species in Europe.

Ecology. These beetles occur in cold, densely shaded water in forested areas. This is the species of *Rhantus* most frequently found in bogs and fens.

Distribution. Map 243. This species is Holarctic. The Palaearctic range spans boreal Eurasia from eastern Siberia to Britain. In North America the range is transcontinental, primarily in the boreal zone.



Map 243. ***Rhantus suturellus*** **(Harris). Canadian and Alaskan collection localities and United States state records.**

Genus *Colymbetes* Clairville 1806
Fig. 180.

Colymbetes Clairville 1806: 188. Type species - *Dytiscus striatus* Linnaeus, designated by Curtis 1828.

Cymatopterus Dejean 1833: 54. Type species - *Dytiscus fuscus* Linnaeus, designated by Thomson 1859.

Diagnosis. Large beetles, length = 11.0 to 20.0 mm; body (Fig. 180A) elongate-oval, length: width generally greater than 2.0; lateral outline more or less continuous in dorsal aspect.

Color various, dorsally ranging from yellow to dark brown, variously maculate; ventral surface mainly black; appendages yellow to black. Head and pronotum with coarse primary meshes of various size and shape; microreticulation present or not; elytron (Fig. 180A) with parallel, transverse, sharply etched grooves extending from near suture to almost lateral margins, interspaces with variously developed microreticulation. Ventral surface with prominent meshes or oblique lines over most of surface.

Pronotum lacking lateral bead. Prosternal process rounded and broadly convex medially, apex short and blunt, in lateral aspect somewhat deflected upwards posterad of procoxae. Metasternum anteromedially slightly flattened, not or only slightly impressed. Metasternal wings broad. Metatarsomeres 1 to 4 lobed apically; metatarsal claws unequal, larger inner claw more than twice length of outer claw. Abdomen sternum 2 with posterolateral margin bearing a series of short longitudinal grooves, best developed on male (presumably file of a stridulatory organ, plectrum anterior margin of metafemur).

Male with protarsomeres 1 to 3 moderately to broadly dilated, ventrally bearing dense adhesive hairs, large scales, or a combination of the two; protarsal claws little

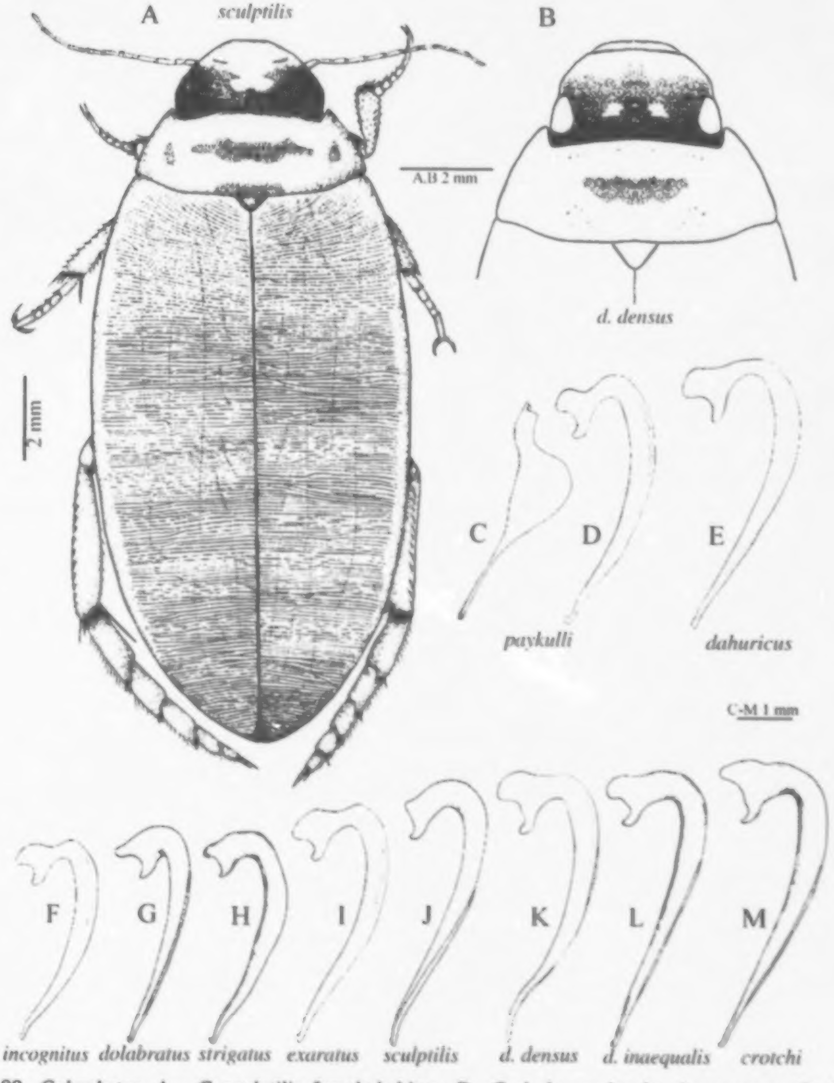

A
sculptilis
B
A,B 2 mm
2 mm
d. densus
C
D
E
paykulli
dahuricus
C-M 1 mm
F
G
H
I
J
K
L
M
incognitus
dolabratus
strigatus
exaratus
sculptilis
d. densus
d. inaequalis
crotchi

Fig. 180. *Colymbetes*. A. - *C. sculptilis*, female habitus. B - *C. d. densus*, head and pronotum. C - *C. paykulli*, paramere. D - M, aedeagus lateral. D - *C. paykulli*. E - *C. dahuricus*. F - *C. incognitus*. G - *C. dolabratus*. H - *C. strigatus*. I - *C. exaratus*. J - *C. sculptilis*. K - *C. d. densus*. L - *C. densus inaequalis*. M - *C. crotchi*. (C - M from Zimmerman 1981a).

modified. Parameres (Fig. 180C)symmetrical, base broad, abruptly narrowed about middle and produced as a slender sparsely setose style; aedeagus (Fig. 180D – M) long and slender, apex somewhat thickened and in some specimens produced into a small hook. Female with gonocoxa flattened, moderately sclerotized, elongate but rounded apically, with short setae.

Comments. Some European authors have recognized two subgenera: *Colymbetes* s. str. and *Cymatopterus* Dejean. However, the diagnostic character, the ventral vestiture of the male protarsomeres, occurs in intermediate states in some North American species so that a clear subdivision does not exist. The genus contains over 20 species, of which three are Holarctic (Nilsson and Holmen 1995). Zimmerman (1981*a)*, in a revision of North American species, recognized seven North American species. We recognize nine species by elevating *C. exaratus incognitus* Zimmerman and *C. strigatus crotchi* Sharp to rank of full species. Geographical variation is complex in some species and species limits in the *C. sculptilis - exaratus - dolabratus* complex needs further investigation.

Hilsenhoff (1989, 1993*b)* discussed characters for the recognition of larvae of some species.

Key to species of *Colymbetes* of North America

(modified from Zimmerman 1981*a)*

1. Ventral surface including legs entirely dark, piceous to black; male pro- and mesotarsomeres 1 to 3 bearing dense adhesive setae but no larger scales 2

1'. Ventral surface of body and legs at least partly yellow to pale reddish; male pro- and mesotarsi bearing large scales or large scales and adhesive setae on ventral surface 3

2(1). Pronotum with narrow, irregular meshes which are distinctly transverse on anterolateral portion of disc; pronotum dark rufous except for a transverse black discal spot; aedeagus with apex somewhat thickened but without an acute tooth (Fig. 180E) ....1. *C. dahuricus* (Aubé)

2'. Pronotum with sculpture consisting of broad, irregular meshes with little or no tendency toward transverse arrangement; pronotum largely black with side margin and on many specimens also a small mediolateral area on disc, rufous; aedeagus with apex bearing an acute ventral hook (Fig. 180D) ....2. *C. paykulli* Erichson

3(1). Head (frons) swollen in front of eye and over base of antenna (Fig. 180B); male pro- and mesotarsomeres 1 to 3 with both scales and adhesive setae on ventral surface; aedeagus elongate, length 5.6 to 6.9 mm 4

3'. Head with frons evenly converging anterad of eye and not swollen (Fig. 180A); male pro- and mesotarsomeres of most specimens bearing only oval scales beneath; aedeagus shorter, length = 3.3 to 5.5 mm 6

4(4). Disc of pronotum without microreticulation; aedeagus (Fig. 180M) very long, length = 6.3 to 6.9 mm; coastal California from Mendocino to Monterey ....*C. crotchi* Sharp 1882*a*

4'. Disc of pronotum with microreticulation; aedeagus length 5.4 to 6.3 mm 5

5(4). Aedeagus in lateral aspect sinuate towards apex; aedeagus (Fig. 180K) length = 5.4 to 6.0 mm; Alaska to northern Oregon, east to Wyoming, Montana and Alberta ....3. *C. densus densus* LeConte

5'. Aedeagus in lateral aspect with shaft more or less straight towards apex; aedeagus (Fig. 180L) length = 5.6 to 6.3 mm; southern Oregon and northern California ....3. *C. densus inaequalis* Horn

6(3). Metatibia largely dark reddish brown to piceous; epipleuron often somewhat darkened; elytral grooves relatively widely spaced, about 9 to 10 grooves per mm; males usually with basal adhesive scales of protarsomere 1 reduced in size; aedeagus (Fig. 180H) length = 4.0 to 5.1 mm; southern half of California and adjacent Nevada .... *C. strigatus* LeConte 1851

6'. Metatibia yellow or variously darkened medially; epipleuron yellow; elytral grooves spaced about 12 to 13 grooves per mm; males with adhesive scales of protarsomeres of similar size; aedeagus length = 3.3 to 5.6 mm; widespread but if in California or Nevada, aedeagus length less than 4.0 mm 7

7(6). Aedeagus (Fig. 180J) long, total length 5.0 to 5.6 mm; metafemur broad, length: width = 3.1 to 3.4, distinctly suffused with brown medially; male protarsus moderately wide, width protarsomere 1 = 0.64 to 0.79 mm; length = 14.1 to 18.0 mm; transcontinental in forested regions .... 4. *C. sculptilis* Harris

7'. Aedeagus Fig. 180F, G, I) shorter, length less than 5.0 mm; metafemur of various width, entirely pale or suffused with brown; male protarsus of various width; size generally smaller, length = 12.9 to 16.8 mm; northern and Great Plains and west 8

8(7). Distribution arctic, subarctic and alpine; metafemur slender, length: width greater than 3.4, distinctly suffused with brown along much of length .... 5. *C. dolabratus* (Paykull)

8'. Boreal zone and south; metafemur broader, length: width less than 3.4, entirely yellow or with brown color occupying no more than basal third 9

9(8). Aedeagus length = 4.1 to 4.9 mm; metafemur yellow or with some brown pigmentation basally; eastern and northern Great Plains, British Columbia and Yukon .... 6. *C. exaratus* LeConte

9'. Aedeagus length = 3.3 to 3.9 mm; metafemur entirely yellow; western United States to western Great Plains, southern Alberta .... 7. *C. incognitus* Zimmerman

1. *Colymbetes dahuricus* Aubé 1836

Fig. 180E

Colymbetes dahuricus Aubé 1836: 99 – 100. Type locality - "Daurie".

Colymbetes seminiger LeConte 1862: 522. Type locality - Saskatchewan.

Selected References. Larson 1975: 388 (as *C. seminiger*); Zimmerman 1981*a*: 37 – 38; Larson 1997*b*: 512.

Description. Length = 16.2 to 20.0 mm; width = 8.3 to 9.8 mm; length: width = 1.98 to 2.13. Body large.

Color dark. Pronotum rufous to dark rufous with a large median transverse dark mark on disc (many specimens with additional dark spots laterad and posterior to medial fascia). Elytron light brown with transverse grooves black; epipleuron largely black except for basal and usually apical rufous areas. Ventral surface, including legs, piceous to black.

Pronotum with lines of primary sculpture dense, in form of narrow stretched meshes which are strongly transverse in arrangement anterolaterally on disc.

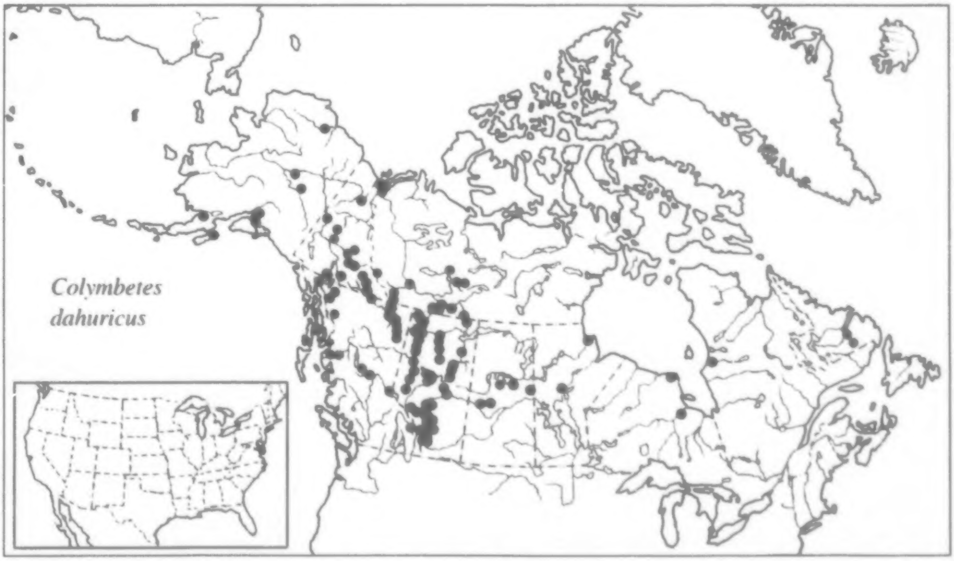
Head with lateral margin not inflated anterad of eye. Pronotum in dorsal aspect with lateral margin distinctly sinuate near anterolateral angle.

Male pro- and mesotarsomeres 1 to 3 bearing dense covering of small adhesive setae on ventral surface, larger scales lacking. Aedeagus (Fig. 180E) with apex thickened apically but without an acute hook.

Comments. This species was generally known as *C. seminiger* LeConte in North America until Zimmerman (1981) synonymised it with the Palaearctic *C. dahuricus*. All Nearctic specimens that we have examined can be distinguished by greater transverse stretching of the meshes of the pronotal sculpture. Also, there seem to be differences in the length and shape of the aedeagus between Nearctic and Palaearctic specimens (Larson 1975). This synonymy needs to be re-evaluated.

Ecology. These insects occur only in forested areas. The beetles occupy permanent waters, generally where there is dense emergent vegetation such as *Carex* and *Sphagnum* and the area is shaded by shrubs such as willows. They commonly occur along the margins of boggy lakes and old, established beaver ponds.

Distribution. Map 244. The range is transcontinental in the boreal zone, however there are very few collection records east of Manitoba. The distribution is similar to that of *C. paykulli* but the species is more common in the northern regions.



Map 244. *Colymbetes dahuricus* Aubé. Canadian and Alaskan collection localities and United States state records.

2. *Colymbetes paykulli* Erichson 1837

Fig. 180C, D

Colymbetes paykulli Erichson 1837: 149. Type locality - not given.

Colymbetes longulus LeConte 1862: 522. Type locality - "Lake Superior and Methy".

Selected References. Larson 1975: 387 (as *C. longulus*); Zimmerman 1981*a*: 40 – 41; Hilsenhoff 1993*b*: 124 – 125; Nilsson and Holmen 1995: 145; Larson 1997*b*: 512.

Description. Length = 15.7 to 18.6 mm; width = 8.1 to 9.1 mm; length: width = 2.02 to 2.19.

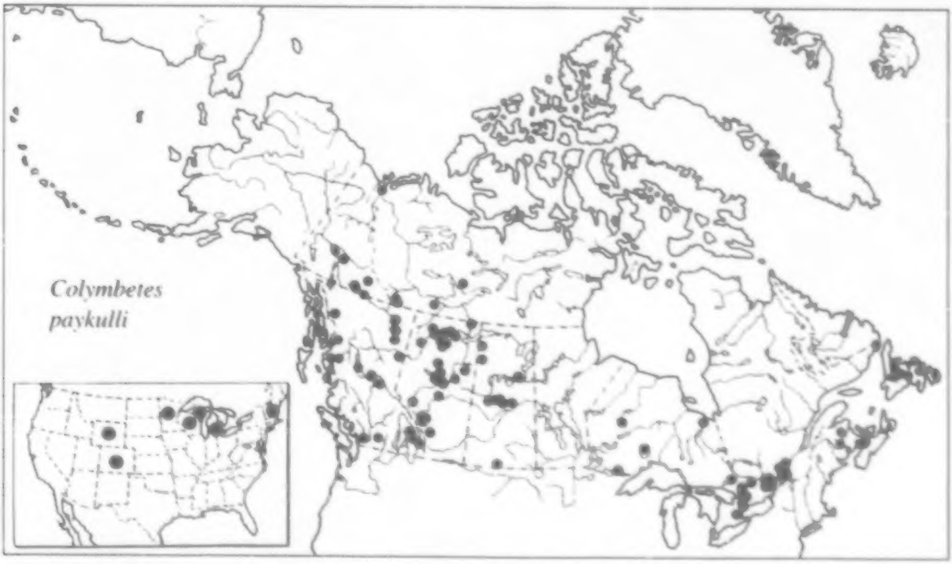
Color very dark. Pronotum black except lateral margins and a mediolateral spot on each side, rufous. Elytra brown except transverse grooves and epipleuron black. Ventral surface including legs, dark piceous to black.

Pronotum with lines of sculpture deeply impressed, meshes irregular or some specimens with a slight tendency to transverse arrangement on anteromedial portion of disc and longitudinal arrangement on basolateral portion of disc.

Head with frons not swollen in front of eye. Pronotum in dorsal aspect with lateral margin evenly rounded or slightly sinuate near anterolateral angle.

Male with pro- and mesotarsomeres 1 to 3 bearing adhesive setae on ventral surface, larger scales absent. Aedeagus (Fig. 180D) with apex bearing an acute hook.

Ecology. These beetles are almost entirely restricted to the cold water of *Sphagnum* bogs. They occur most frequently in small pools with emergent *Carex*, or along the edges of bog-ringed lakes in embayments and beaver runs, often in or near the willow zone.



Map 245. *Colymbetes paykulli* Erichson. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 245. The range is transcontinental and largely boreal although the species does occur south along the Rocky Mountains into Colorado.

3. *Colymbetes densus* LeConte 1859

Fig. 180B, K. L

Colymbetes densus LeConte 1859*b*: 282. Type locality - Oregon - Washington.

Selected References. Larson 1975: 388 – 389 (as *C. exaratus*); Zimmerman 1981*a*: 34 – 37, 1981*b*: 43 – 51; Larson 1997*b*: 512.

Description. Length = 15.7 to 18.4 mm; width = 8.0 to 8.7 mm; length: width = 2.02 to 2.18.

Color of head black posteriorly, rufous anteriorly. Pronotum yellow to rufous with a dark transverse medial bar, and on many specimens, a small dark spot on each side laterad to bar. Elytron, including epipleuron, yellow to pale brown with transverse lines black. Ventral surface piceous to black except metacoxal process and apices of abdominal sterna, rufous. Legs rufous except femora dark brown to piceous ventrally and medially.

Pronotum with lines of sculpture deep and coarse, relatively widely separated and forming very irregular meshes with only slight tendency towards transverse arrangement anteriorly and laterally. Secondary microreticulation fine, obsolete medially on frons and disc of pronotum but well developed on disc of elytron.

Head (Fig. 180B) with lateral margin of frons conspicuously inflated in front of eye. Pronotum in dorsal aspect with lateral margin evenly rounded.

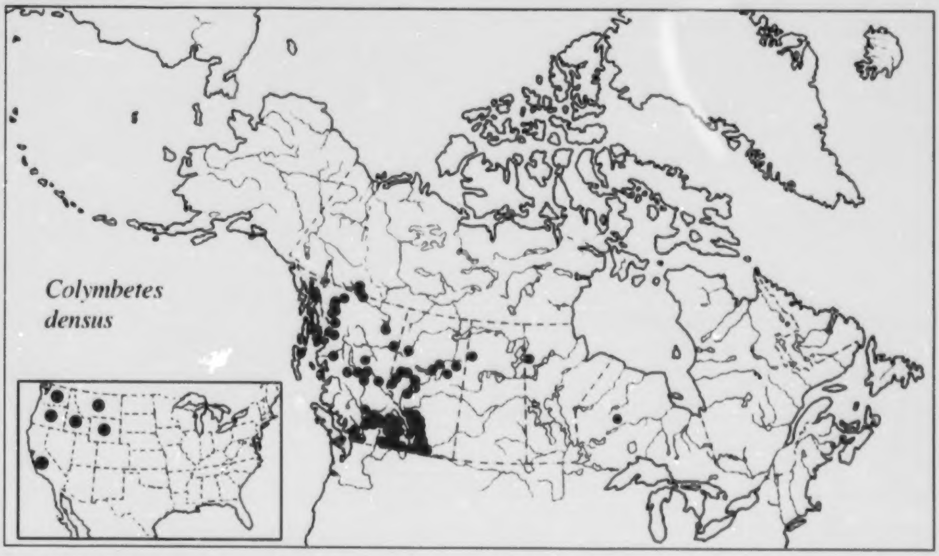
Male with pro- and mesotarsomeres 1 to 3 conjointly with a basal pad of adhesive setae and three more distal transverse rows of larger scales. Aedeagus (Fig. 180K, L) very elongate, sinuate apically and with an acute apical hook.

Comments. Geographical variation in this species is complex. The nominate subspecies, *C. d. densus* is fairly homogeneous over its range which extends from western Ontario to southern Yukon Territory and Alaska and south to Wyoming and central Oregon. A second subspecies, *C. d. inaequalis* Horn 1871, occurs in southern Oregon and California. It is characterized by the female having a megascopically distinct pale line bordering the sutural margin of the elytron, female elytron with coarse microsculpture present between transverse grooves and the aedeagus is less bent apically. *Colymbetes strigatus* LeConte, which occurs in California and Nevada, intergrades with *C. c. inaequalis* in a complex way which has been described by Zimmerman (1981*a, b*).

Ecology. These beetles occur amongst dense, emergent vegetation along the margins of marshes, pools and lakes in mountainous and boreal regions of western North America.

Distribution. Map 246. The species has a wide range in the Cordilleran region of western North America, extending from the Yukon and Alaska south to California, Nevada and Wyoming. Specimens have also been taken in the boreal portions of the prairie provinces east to northern Ontario.

19



Map 246. *Colymbetes densus* LeConte. Canadian and Alaskan collection localities and United States state records.

4. *Colymbetes sculptilis* Harris 1829

Fig. 180A, J

Colymbetes sculptilis Harris 1829: 8. Type locality - Randolph, Coos Co., New Hampshire.

Selected References. Larson 1975: 389 – 394; Zimmerman 1981*a*: 18 – 27; Hilsenhoff 1993*b*: 125; Larson 1997*b*: 512.

Description. Length = 14.1 to 18.0 mm; width = 6.5 to 8.5 mm; length: width = 2.00 to 2.20. Habitus as in Fig. 180A.

Head black basally, anterior portion and frontal spots pale. Pronotum yellow to pale rufous with a medial transverse spot and on some specimens a smaller spot on each side laterad of medial spot, piceous. Elytra including epipleuron, yellow, transverse grooves black. Ventral surface mainly black. Legs yellow to pale rufous with femora medially darkened, brown to piceous.

Pronotum with lines of sculpture deeply impressed, forming very irregular meshes with at most a slight tendency towards transverse arrangement.

Head with lateral margin not inflated in front of eyes. Pronotum with lateral margin evenly arcuate in dorsal aspect. Metafemur wide, length: width = 3.1 to 3.4.

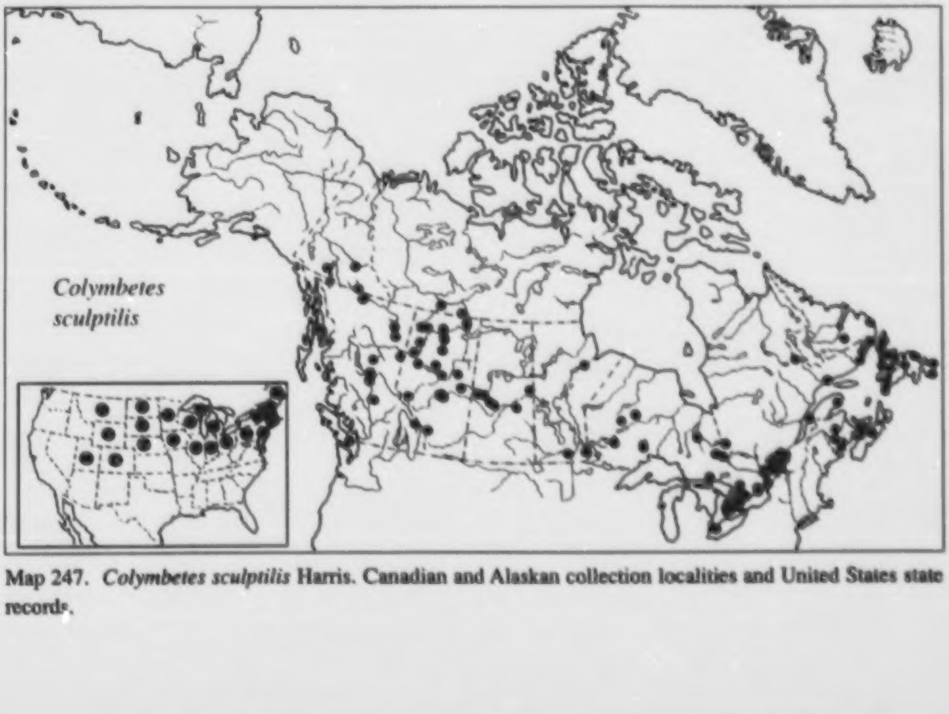
Male with pro- and mesotarsomeres 1 to 3 together bearing 4 transverse rows of scales on ventral surface, adhesive setae absent; protarsus with maximum width 0.64 to 0.79 mm. Aedeagus (Fig. 180J) length 4.9 to 5.6 mm, apex with an acute hook.

Comments. No other group of water beetles within the fauna poses as many taxonomic problems as the *C. sculptilis* complex. This complex includes those species characterized by partly or largely pale legs, frons not swollen anterior to eye and male protarsal vestiture consisting of scales of more or less similar size. Separation of male specimens is best done on the basis of width of protarsus, length of aedeagus and relative width of metafemur. Females are generally difficult to separate although degree of infuscation of the femora and details of sculpture may be of value in some cases.

Zimmerman (1981*a)* separated *C. sculptilis* from the more northern, smaller *C. dolabratus* on the basis of size and width of the hind femur. However, he noted that *C. dolabratus* becomes larger and has wider metafemora in eastern Quebec where its range approaches that of *C. sculptilis*. A similar pattern also occurs in the Yukon.

Young and Severin (1956) synonymised *C. exaratus* with *C. sculptilis* as intergrading subspecies in South Dakota. Zimmerman (1981*a)* did not accept this synonymy and recognized the two as distinct, with *C. exaratus* being composed of two subspecies, *C. e. exaratus* and *C. e. incognitus*. However, he did note that "other than the aedeagus it is difficult to point to a single character that will separate all individuals of *e. incognitus* from *sculptilis*." Larson (19975) noted variation in length, aedeagus length, and width of male protarsus amongst Alberta specimens of the complex and interpreted this as clinal variation. However, variation between the characters is correlated and shows a geographical pattern. The three forms Larson recognized are, according to Zimmerman (1981): form A = *C. exaratus incognitus*; form B = *C. e. exaratus*; and form C = *C. sculptilis*. The two subspecies of *C. exaratus* differ from each other by as much as they differ from *C. sculptilis*, therefore we accord all equivalent status as full species.

Although specimens of *C. densus* are generally easily separated from members of the *C. sculptilis* complex, Larson (1975) noted a population from Valleyview Alberta in which individuals were intermediate between *C. densus* and *C. sculptilis* in degree of swelling of the anterior margin of the frons and in the male protarsal vestiture. Zimmerman (1981*b)* also noted similar intergradation between *C. densus* and *C. strigatus* in California.



Map 247. *Colymbetes sculptilis* Harris. Canadian and Alaskan collection localities and United States state records.

Ecology. These insects occur among emergent plants such as *Typha*, *Carex* or *Scirpus* at the margins of lakes and permanent or longer-lasting temporary ponds.

Distribution. Map 247. This has the widest range of any North American species of *Colymbetes*. The range extends throughout the boreal zone from Newfoundland to Alaska and south to Virginia and Colorado.

5. *Colymbetes dolabratus* (Paykull 1798)
Fig. 180G

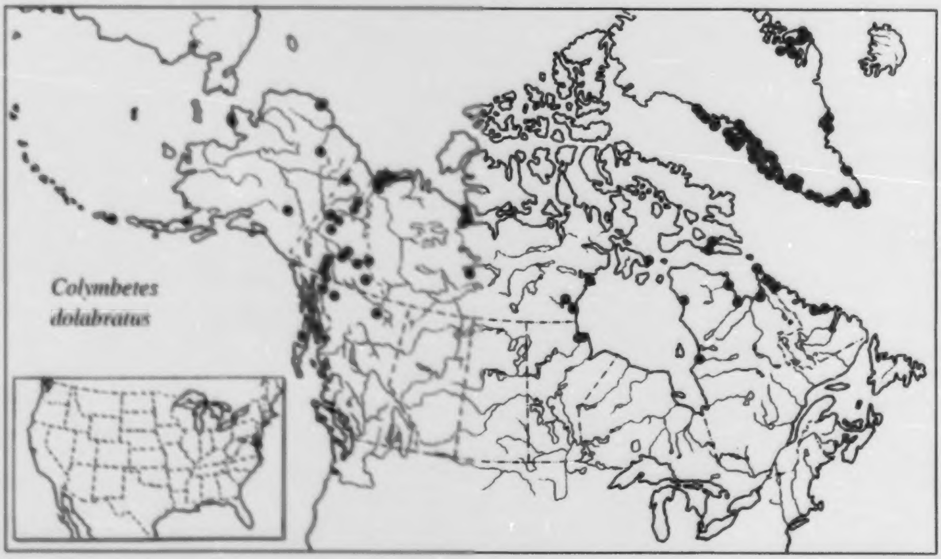
Dytiscus dolabratus Paykull 1798: 204. Type locality - Sweden.

Selected References. Zimmerman 1981*a*: 10 – 13; Larson 1997*b*: 512.

Description. Very similar to *C. sculptilis*, differing in smaller size, length = 12.9 to 16.8 mm; metafemur slenderer, length: width = 3.4 to 4.0; male protarsus with maximum width 0.50 to 0.73 mm; and aedeagus (Fig. 180G) shorter, length = 3.4 to 3.9 mm.

Ecology. This species is lentic and has been collected from the emergent zone of ponds and lakes.

Distribution. Map 248. This Holarctic species occurs throughout the arctic and subarctic regions of North America and Greenland. In the west it extends south into northern B.C. in the alpine zone. The specimens from southern Labrador and Newfoundland that Zimmerman (1981*a)* assigned to this species, we believe are better placed in *C. sculptilis*. Zimmerman noted the limits between these two species are obscure in the northern boreal region.



Map 248. *Colymbetes dolabratus* (Paykull). Canadian and Alaskan collection localities and United States state records.

6. *Colymbetes exaratus* LeConte 1862

Fig. 180I

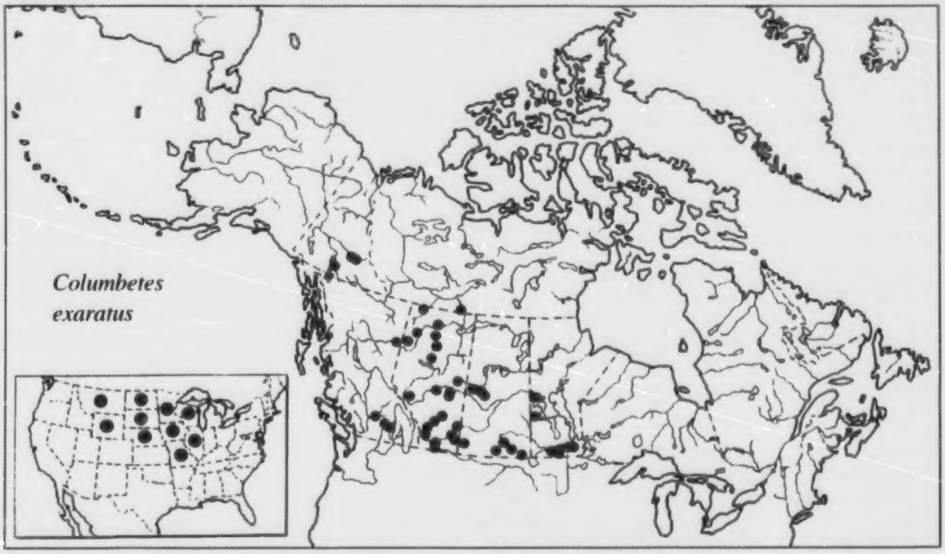
Colymbetes exaratus LeConte 1862: 522. Type locality - Methy, Saskatchewan.

Selected Eeferences. Larson 1975: 391 – 392 (as *C. sculptilis* form B; *C. exaratus* sensu Larson 1975 is actually *C. densus*); Zimmerman 1981*a*: 13 – 16; Hilsenhoff 1993*b*: 124.

Description. Very similar to *C. sculptilis*, only the male can be reliably recognized. Diagnostic characters are: length = 14.1 to 16.5 mm; metatibia broad, length: width = 3.1 to 3.4, pale, entirely yellow or pale rufous or with some suffusion of brown on basal third; male protarsi broad, maximum width = 0.77 to 0.86 mm; aedeagus (Fig. 180I) of intermediate length, length = 4.2 to 4.9 mm.

Ecology. Specimens occur among dense emergent vegetation, often *Typha* or *Carex*, at the margin of ponds, sloughs or marshes in grassland or parkland regions.

Distribution. Map 249. The range extends from the Great Lakes to central British Columbia and from the southern Yukon and Northwest Territories to Nebraska and Missouri.



Map 249. *Colymbetes exaratus* LeConte. Canadian and Alaskan collection localities and United States state records.

7. *Colymbetes incognitus* Zimmerman 1981

Fig. 180F

Colymbetes incognitus Zimmerman 1981a: 16 – 18. Type locality - 1 mi N Happy Jack, Coconino Co., Arizona.

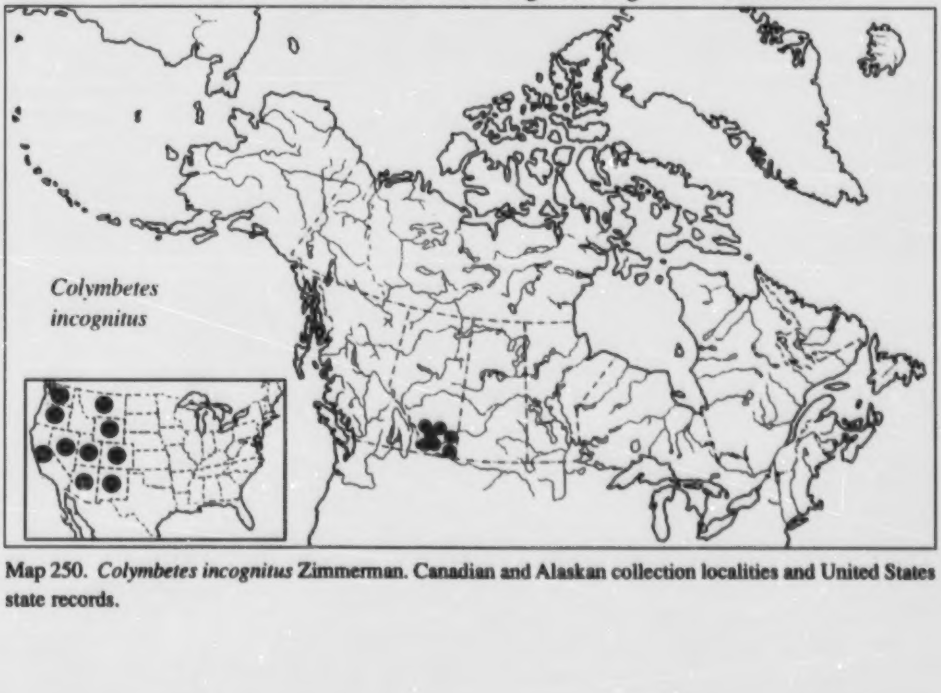
Selected References. Larson 1975: 390 – 392 (as *C. sculptilis* form A); Zimmerman 1980: 213 – 226; Zimmerman 1981*a*: 16 – 18.

Description. Similar to *C. sculptilis* and *C. exaratus*, distinguished as follows: size smaller, length = 13.9 to 16.0 mm; color paler, legs entirely yellow, without suffusion of brown on metatibia; metatibia broad, length: width less than 3.4; male protarsi of intermediate width, maximum width = 0.57 to 0.73 mm; aedeagus (Fig. 180F) short, length = 3.4 to 3.9 mm.

Comments. Zimmerman described *C. incognitus* as a subspecies of *C. exaratus*. He reached this conclusion through a multivariate analysis of seven mensural, nonsexual characters (Zimmerman 1980). This analysis demonstrated that the taxa treated here as *C. sculptilis*, *C. exaratus* and *C. incognitus*, first separated on the basis of aedeagal length, could also be separated through discriminant analysis using the seven mensural characters. The forms *C. exaratus* and *C. incognitus* showed intergradation in southern Alberta thus Zimmerman considered them to be subspecies of one species. However, Zimmerman did not standardize these measurements in relation to the size of the insect so that each character provided a measurement of size. Because of this, the major conclusion that can be drawn from the study is that the three forms differ in body size with the greatest overlap being between *C. exaratus* and *C. incognitus* in southern Alberta. When characters that do differ between these taxa, independently of body size, are used (e.g. length of aedeagus and width of male protarsus), the disjunction between *C. exaratus* and *C. incognitus* is at least equal to, if not greater than, that between *C. exaratus* and *C. sculptilis* (Larson 1975: 390 – 394, Fig. 2; Zimmerman 1980, Figs. 3, 4). For this reason we give these three groups equal rank. Species rank is indicated because these two sexual characters provide consistent segregation within the zones of sympatry.

Ecology. In southern Alberta, specimens have been collected from emergent grasses and rushes at the margin of grassland ponds. The ponds may be temporary or even distinctly saline.

Distribution. Map 250. The range extends from the western portions of the Great Plains, southern Alberta to New Mexico, west to Washington, Oregon and California.



Map 250. *Colymbetes incognitus* **Zimmerman. Canadian and Alaskan collection localities and United States state records.**

SUBFAMILY DYTISCINAE LEACH

Diagnosis. Size moderate to very large, length of North American species = 7.5 to 40 mm. Shape broadly oval to elongate, slightly to strongly depressed; lateral outline more or less continuous.

Color various, yellow with various dorsal maculations to entirely dark piceous or black. Sculpture various, dorsal surface with fine punctation; surface glabrous or some females with setose elytral sulci.

Eyes large, convex, anterior margin not emarginate above base of antenna. Antenna slender. Pronotum of most specimens without a lateral bead, lateral bead narrow when present. Scutellum visible. Prosternum medially and its process in same plane in lateral aspect. Metepisternum reaching mesocoxal cavity. Metacoxa various, from moderate in size with adjacent metasternal wings triangular, to very large with metasternal wings narrow and strap-like laterally; metacoxal lines various, well developed to obsolete, somewhat convergent anterior to metacoxal processes but not closely approximate; metacoxal process well developed and covering base of metatrochanter, rounded to acutely pointed apically. Metatibia with upper face bearing apically emarginate setae. Metatibia and metatarsus with dorsal and ventral fringes of natatorial setae present in male, present or absent from female. Metatarsomeres with apical margin lobed or not; metatarsal claws various, subequal, unequal or only a single claw present.

Male protarsomeres 1 to 3 greatly broadened and together forming a round to oval palette, ventral surface of palette with adhesive suckers or setae of various size and number. Parameres and aedeagus broadly joined dorsally by membrane. Gonocoxa fused, of various forms, generally elongate and tube-like to blade-like but not toothed.

Comments. This subfamily contains five tribes, all of which are represented in North America. The greatest species diversity occurs within the Old World tropics but the members of several genera are north temperate. Some species are boreal but only a few attain the southern edge of the low arctic.

The subfamily contains the largest and strongest swimming members of the family. These beetles are generally lentic and because they tend to inhabit deeper and more open sites than other members of the family, are more frequently noticed by casual observers. However, some species, such as most species of *Hydaticus*, typically occur amongst dense vegetation. Most species have wide distributions and many species fly readily, especially at night, so that they are frequently collected at light.

Key to tribes and genera of Dytiscinae of North America

1. Metatarsomeres 1 to 4 with dorsoapical margin bare; size large, length = 18 to 40 mm 2

1'. Metatarsomeres 1 to 4 each with dorsoapical margin bearing a row of flat, yellow setae; size smaller, length less than 18 mm 4

2(1). Metatibia very short and broad (length: width less than 2.0), its length about 0.5 length of metafemur; metatibial spurs large, ventral spur dilated and much broader than dorsal spur; prosternum in lateral aspect with anterior margin abruptly elevated, its anteroventral angle more or less right-angled .... Cybistrini, 3

2'. Metatibia slenderer (length: width about 3.0), its length about 0.66 to 0.75 length of metafemur; ventral and dorsal metatibial spurs of similar width, spurs evenly narrowed to apex; prosternum not abruptly elevated anteriorly, in lateral aspect its anteroventral angle broadly obtuse .... Dytiscini, *Dytiscus* Linnaeus, p. 774

3(2). Male metatarsus with two subequal claws; female metatarsus with a long outer claw and a rudimentary inner claw; elytron without lateral yellow stripe although lateral margin may be diffusely reddish; North American species length less than 25 mm .... *Megadytes* Sharp [A predominantly Neotropical genus with one North American species, *M. fraternus* Sharp, s. United States]

3'. Metatarsus of male with one claw; female metatarsus usually with only one claw; elytron with a lateral yellow stripe; North American species length greater than 25 mm .... *Cybister* Curtis, p. 831

4(1). Prosternal process with apex sharply pointed; pronotum margined laterally; elytron with lateral margin in apical half bearing a marginal row of short, stout spines .... Eretini, *Eretes* Laporte, p. 829

4'. Prosternal process rounded apically; pronotum without a marginal bead; elytron without spines along lateral margin 5

5(4). Metasternal wing with outer margin straight; metatibial spurs each with apex acute .... Hydaticini, *Hydaticus* Leach, p. 796

5'. Metasternal wing with outer margin arcuate; metatibial spurs each with apex finely emarginate .... Aciliini, 6

6(5). Elytron densely and coarsely punctate; male protarsal palette ventrally with 3 round adhesive discs and two dense clumps of adhesive hairs; female elytron with or without longitudinal sulci, sulci when present bearing elongate setae .... *Acilius* Leach, p. 804

6'. Elytron densely punctate but punctures fine and inconspicuous; male protarsal palette with 15 to 30 adhesive discs, without dense clumps of adhesive hairs; female elytron without longitudinal sulci 7

7(6). Mesofemur with hind margin bearing a series of stiff, erect setae which are longer than width of femur at their base; mesotarsomeres 1 to 3 apicoventrally with a pair of elongate stout setae which are subequal to length of following tarsomere; many females with short, deep strioles on basal parts of elytron .... *Thermonectus* Dejean, p. 823

7'. Mesofemur with setae of hind margin shorter than width of femur at their base; mesotarsomeres with apical setae shorter than length of following tarsomere; female elytron without coarse strioles or at most with slightly deepened and elongated punctures .... *Graphoderus* Dejean, p. 814

Tribe Dytiscini Leach 1817

Diagnosis. Dytiscinae of large size, length = 19 to 44 mm. Body elongate oval, maximum width near middle.

Color of dorsal surface dark rufous to black, front of head and margins of pronotum and elytra variously yellow to reddish. Microreticulation fine; punctation fine to relatively coarse and dense.

Pronotum with posterolateral angle right-angled to slightly obtuse; lateral bead absent (present in *Hyderodes* Hope). Prosternal process flattened to convex, broadly rounded to pointed apically and received into a short, broad impression on metasternum. Metacoxae not enlarged; metasternal wing triangular with anterolateral margin arcuate. Hind legs robust but not strongly broadened; metatibial spurs similar in shape, more or less evenly narrowed from base to apex and acuminate apically; metatarsomeres 1 to 4 with apical margin lobed laterally, without apical fringe of flattened yellow setae; metatarsal claws subequal in length. Male metatibia and metatarsus with ventral fringe of natatorial setae, female lacking these.

Male protarsomeres 1 to 3 conjointly expanded to form a round palette, ventral surface with 2 large round discs basally and a variable number of smaller discs; mesotarsomeres 1 to 3 broadened, with numerous small adhesive scales ventrally. Genitalia with parameres elongate, symmetrical and with ventroapical setae. Female gonocoxae laterally compressed, elongate and sclerotized.

Comments. This tribe contains two genera, the Holarctic genus *Dytiscus* and *Hyderodes* Hope 1838 with two species in southern Australia. This tribe is complimentary in its world distribution to the Cybistrini, a tribe of similarly large beetles which occur in warm temperate to tropical regions.

Genus *Dytiscus* Linnaeus 1758

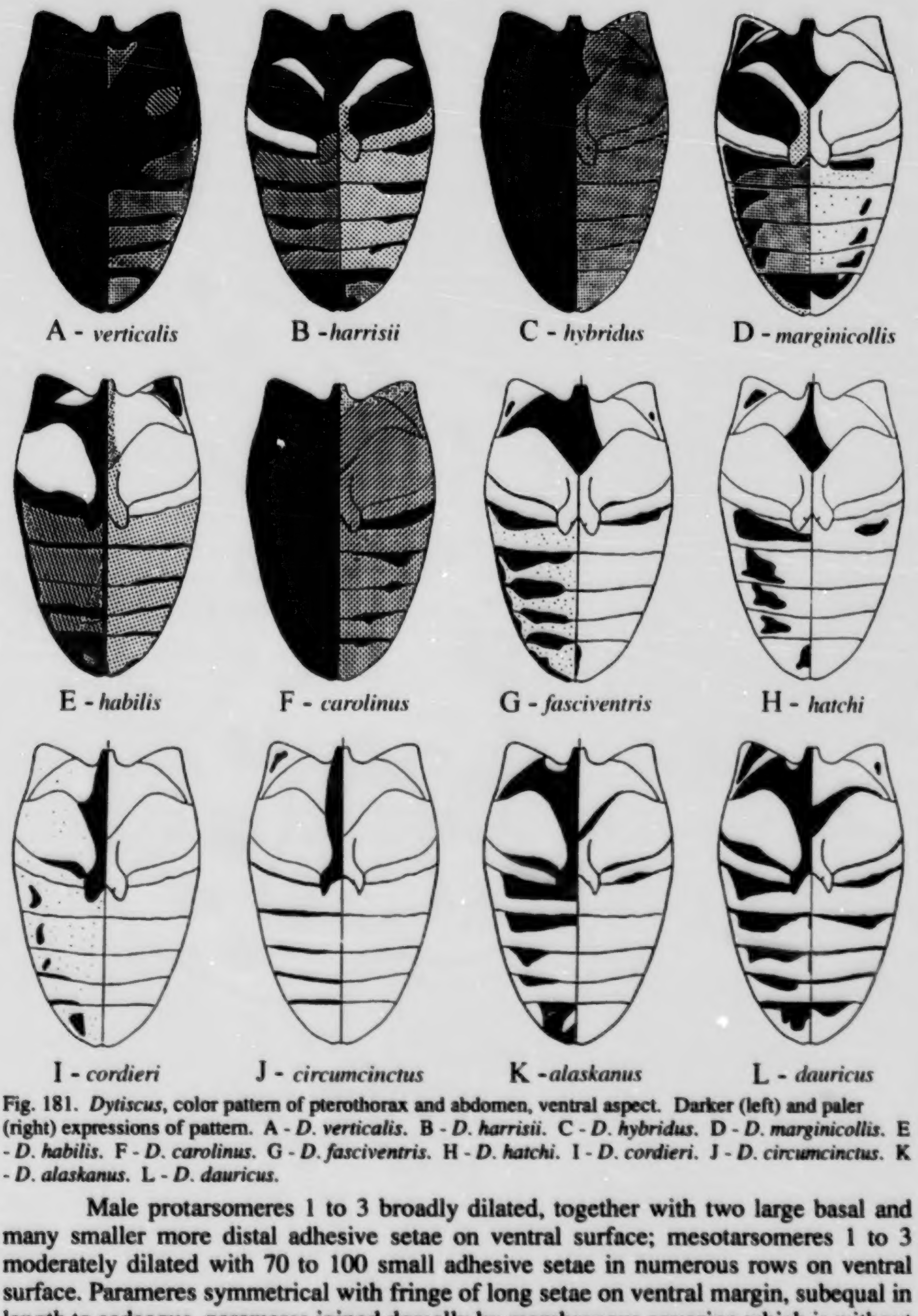
Frontispiece; Figs. 181; 182.

Dytiscus Linnaeus 1758: 411. Type species - *Dytiscus marginalis* Linnaeus, designated by Latreille 1810; 426.

Diagnosis. Nearctic specimens of very large size, length = 22.0 to 40.0 mm. Shape elongate oval in dorsal aspect with lateral outline more or less continuous; moderately convex dorsoventrally in lateral aspect. Color reddish brown to black with pronotum variously margined with yellow; elytron with yellow lateral margin and some specimens with a subapical transverse band (*Frontispiece*).

Sculpture generally sexually dimorphic, female with coarser punctation than male; some females with elytra longitudinally sulcate (*Frontispiece*), this varying between species as well as within some species.

Clypeus with anterolateral foveae rounded and broadly separated medially. Prosternal process acutely to broadly rounded apically, finely margined laterally, received by anteromedial impression of metasternum which does not extended posteriorly past level of middle of mesocoxae. Metacoxal lines well separated, traceable anteriorly to metasternum; metacoxal processes rounded to acuminate and spine-like. Hind legs robust; metafemur with a group of short setae near apicoventral angle.



A - *verticalis* B - *harrisii* C - *hybridus* D - *marginicollis*

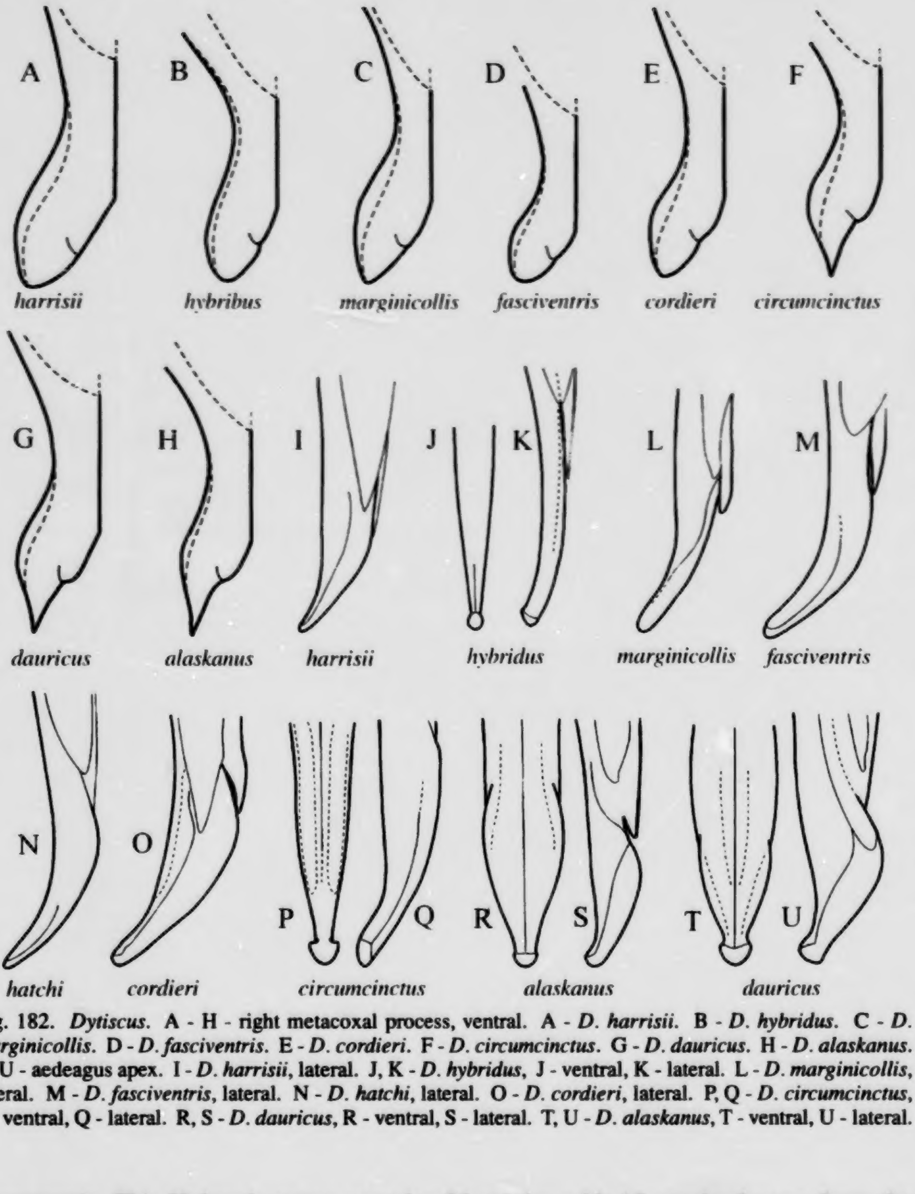
E - *habilis* F - *carolinus* G - *fasciventris* H - *hatchi*

I - *cordieri* J - *circumcinctus* K - *alaskanus* L - *dauricus*

Fig. 181. *Dytiscus*, color pattern of pterothorax and abdomen, ventral aspect. Darker (left) and paler (right) expressions of pattern. A - *D. verticalis*. B - *D. harrisii*. C - *D. hybridus*. D - *D. marginicollis*. E - *D. habilis*. F - *D. carolinus*. G - *D. fasciventris*. H - *D. hatchi*. I - *D. cordieri*. J - *D. circumcinctus*. K - *D. alaskanus*. L - *D. dauricus*.

Male protarsomeres 1 to 3 broadly dilated, together with two large basal and many smaller more distal adhesive setae on ventral surface; mesotarsomeres 1 to 3 moderately dilated with 70 to 100 small adhesive setae in numerous rows on ventral surface. Parameres symmetrical with fringe of long setae on ventral margin, subequal in length to aedeagus, parameres joined dorsally by membranous covering which is without sclerites. Aedeagus with vertically directed lateral flanges.

Female sternum 6 with hind margin emarginate medially. Ovipositor with gonocoxa elongate, sclerotized and knife-shaped, without setae or spines.


A
B
C
D
E
F
harrisii
hybribus
marginicollis
fasciventris
cordieri
circumcinctus
G
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I
J
K
L
M
dauricus
alaskanus
harrisii
hybridus
marginicollis
fasciventris
N
O
P
Q
R
S
T
U
hatchi
cordieri
circumcinctus
alaskanus
dauricus

Fig. 182. *Dytiscus*. A - H - right metacoxal process, ventral. A - *D. harrisii*. B - *D. hybridus*. C - *D. marginicollis*. D - *D. fasciventris*. E - *D. cordieri*. F - *D. circumcinctus*. G - *D. dauricus*. H - *D. alaskanus*. I - U - aedeagus apex. I - *D. harrisii*, lateral. J, K - *D. hybridus*, J - ventral, K - lateral. L - *D. marginicollis*, lateral. M - *D. fasciventris*, lateral. N - *D. hatchi*, lateral. O - *D. cordieri*, lateral. P, Q - *D. circumcinctus*, P - ventral, Q - lateral. R, S - *D. dauricus*, R - ventral, S - lateral. T, U - *D. alaskanus*, T - ventral, U - lateral.

Comments. This Holarctic genus contains 26 species with 12 species known from the Nearctic region and 16 species occurring in the Palaearctic region; two species (*D. dauricus* and *D. circumcinctus*) are Holarctic (Roughley 1990). The combination of very large size and the presence of broad yellow bands laterally on the pronotum and elytra separate specimens of *Dytiscus* from all other North American genera except *Cybister* and *Megadytes* (Cybistrini). These two genera are characterized by a broader, more wedge-shaped habitus, larger metacoxae and broader hind legs. As well, the species of Cybistrini are generally more southerly in distribution than most species of *Dytiscus*.

A great deal has been written on the morphology and physiology of these large beetles and the Palaearctic *D. marginalis* L. is one of the most intensively studied species of beetle (e.g., Korschelt 1923, 1924).

These insects live mostly in permanent ponds and lakes. However some prairie species occur in longer lasting temporary ponds and may even be in distinctly saline waters. The insects are associated with aquatic plants but usually in sites where vegetation is open or there are small patches of open water. Specimens are seldom collected from the middle of extensive stands of dense emergent or matted vegetation and possibly their large body size hinders movement in such places. The large larvae (*Frontispiece*) are conspicuous elements of pond faunas in late spring and early summer. These larvae are often referred to as water tigers because of their fierce predatory behaviour. They feed on practically any animal they can catch and overpower although there is evidence that some species show preference or specialization towards particular types of prey.

The most thorough studies of the life history and ecology of any North American species are those of Aiken (1985*c*, 1986*a)* and Aiken and Williamson (1985) on *D. alaskanus* in a north central Alberta lake. Their observations appear to apply well to other species of the genus. Adults overwinter and may even remain active under the ice of ponds that do not freeze completely (Larson 1975). In the spring mating occurs although females may also have mated the previous fall. Based on bottle trap collections of adults, Aiken and Wilkinson (1985) observed a spring population peak (comprised of 6 month-old beetles which eclosed the previous summer as well as some 18 month-old beetles), followed by a general decline over the summer then a small increase in late August and September when newly eclosed beetles joined the population. However, they point out that their trap data may reflect activity patterns of the beetles more than population trends for it is certain fall populations must be greater than the trap captures indicate. Eggs are laid in plant stems and leaves, Aiken and Wilkinson (1985) especially mentioning *Typha* leaves. Eggs hatch within one to two weeks and the three larval instars probably take another four to six weeks to be completed. Full grown larvae pupate in chambers in damp soil or rotted logs close to the waters edge. Recently eclosed teneral beetles appeared in the lake from mid-July to late September. The seasonal timing and duration of these various events no doubt varies between species and habitats but the general pattern is probably generally applicable as indicated by observations by Hilsenhoff (1993*a)* on Wisconsin species.

Evidence suggests that the life span of adult beetles may be quite long. Aiken and Roughley (1985) and Aiken and Wilkinson (1985) found beetles living 18 months in the field, that is into a third summer after eclosion and possibly reproducing twice. Lutz (1948) reported an adult kept alive in an aquarium for three and a half years.

A somewhat contentious point is the role and timing of flight dispersal in the life history. Several authors (Popham 1952; James 1970; Hilsenhoff 1993*a)* postulate that beetles disperse to temporary pools in spring and return to permanent water in late summer and fall when temporary pools are drying. However, in the latitude of Canada there is little evidence of spring dispersal other than occurrence of beetles in atypical habitats, habitats they may have entered the previous fall and overwintered in. On the other hand beetles fly in large numbers in late summer and fall when they may be common at electric light. On the prairies, large flights of *Dytiscus* leave ponds on clear, calm fall evenings even at air temperatures near the freezing point. For most species of

Dytiscus there is probably little seasonal habitat tracking and dispersal occurs primarily in the fall when permanent or semipermanent habitat, the type of habitat occupied by most species, is present.

Key to species of *Dytiscus* of North America

(modified from Larson 1975 and Roughley 1990)

1. Metacoxal process with inner margin convex, apex broadly to narrowly rounded but not acuminate (Fig. 182A – E) 2

1'. Metacoxal process with inner margin concave, apex sharply pointed, more or less acuminate (Fig. 182F – H) 18

2 (1). Clypeus with anterior margin shallowly but distinctly bisinuate; pterothoracic sterna predominantly piceous to black except metacoxa anteriorly and abdominal sternum 1 contrastingly marked with yellow, sterna 2 to 5 or 6 reddish medially (Fig. 181B); female nonsulcate . . . . .2. *D. harrisii* Kirby

2'. Clypeus with anterior margin straight or slightly concave; ventral markings various; females sulcate or not 3

3 (2). Male specimens, protarsomeres 1 to 3 broadly expanded into circular palette, mesotarsomeres 1 to 3 widened 4

3'. Female specimens, pro- and mesotarsomeres 1 to 3 of similar width to 4 and 5 11

4 (3). Mesotarsomeres 2 and 3 ventrally with median glabrous area 5

4'. Mesotarsomeres 2 and 3 ventrally with uniform setation 6

5 (4). Pronotum with posterior yellow band narrow or absent, its maximum width much less than that of lateral band . . . . .3. *D. hybridus* Aubé

5'. Pronotum with posterior yellow band broad, maximum width subequal to that of lateral band . . . . 4. *D. marginicollis* LeConte

6 (4). Abdominal sterna predominantly dark reddish to black (Fig. 181A, E, F) 7

6'. Abdominal sterna with distinct yellow markings (Fig. 181G, H, I) 9

7 (6). Metacoxa predominantly yellow (Fig. 181E); length = 23.0 to 27.5 mm; Oklahoma to Arizona and south to Guatemala . . . .*D. habilis* Say 1834

7'. Metacoxa predominantly black; length = 22 to 36 mm 8

8 (7). Length = 29 to 36 mm; elytron of most specimens with yellow subapical transverse fascia; aedeagus in lateral aspect with apical portion more or less straight . . . . 1. *D. verticalis* Say

8'. Length = 22 to 27 mm; elytron without yellow subapical transverse fascia; aedeagus in lateral aspect with apical portion distinctly curved; southern Wisconsin to Connecticut south to Georgia and Alabama . . . . *D. carolinus* Aubé 1838*b*

9 (6). Head with yellow chevron of frons extended to antennal base, clypeus with anterior margin inflated and raised well above labrum, posterior margin sinuate; elytron with serial punctures visible almost to apex; abdominal sterna of most specimens entirely yellow (Fig. 181I) . . . . .7. *D. cordieri* Aubé

9'. Head with yellow chevron not extended to antennal base, clypeus with anterior margin not inflated although not on same plane as labrum, posterior margin evenly curved; elytron with serial punctures obscured by dense punctation apically; abdominal sterna of most specimens with transverse black marks (Fig. 181G, H) 10

10 (9). Pronotum more broadly margined with yellow; protarsal claws longer than protarsomere 5; northern British Columbia to central California . . . . .6. *D. hatchi* Wallis

10'. Pronotum more narrowly margined with yellow; protarsal claws shorter than protarsomere 5; Nova Scotia to Yukon south to Illinois and British Columbia . . . . .5. *D. fasciventris* Say

11 (3). Head with yellow chevron on frons extended to antennal base; clypeus with posterior margin sinuate medially; metacoxa and abdominal sterna predominantly yellow (Fig. 181I); sternum 6 with longitudinal grooves extending onto disc; elytron sulcate or not . . . . .7. *D. cordieri* Aubé

11'. Head with yellow chevron not extended to antennal base; clypeus with posterior margin arcuate medially; metacoxa or abdominal sterna with black markings; if sternum 6 with longitudinal grooves extending onto disc then metacoxa dark red to black 12

12 (11) Elytron smooth and non-sulcate 13

12'. Elytron with longitudinal grooves or sulci 16

13 (12) Pronotum with basal yellow margin absent or very narrow; metacoxa dark red to black (Fig. 181A , C); sternum 6 with longitudinal grooves extending onto disc 14

13'. Pronotum with basal yellow margin present and quite broad medially; metacoxa with yellow markings (Fig. 181D, E); sternum 6 smooth 15

14 (13). Frons anteromedially coarsely and densely punctate; length = 29 to 36.0 mm; elytron of most specimens with yellow subapical transverse fascia . . . . .1.*D. verticalis* Say

14'. Frons anteromedially finely and sparsely punctate; length = 24 to 28 mm; elytron without subapical fascia but with apical yellow area . . . . .3. *D. hybridus* Aubé

15 (13). Protarsus with claws longer than protarsomere 5; length = 26 to 33 mm; elytron of most specimens with dense punctation over apical half . . . . .4. *D. marginicollis* LeConte

15'. Protarsus with claws shorter than protarsomere 5; length = 23 to 28 mm; elytron of most specimens with dense punctation over apicalquarter; Oklahoma to Arizona and south to Guatemala ....*D. habilis* Say 1834

16 (12). Pronotum broadly margined with yellow posteriorly; protarsal claws longer than protarsomere 5; northern British Columbia to central California ....6. *D. hatchi* Wallis

16'. Pronotum narrowly margined with yellow posteriorly; protarsal claws shorter than protarsomere 5; transcontinental 17

17 (16). Metepisternum and metacoxa dark red to black (Fig. 181F); length = 22 to 26 mm; Connecticut to southern Wisconsin, south to Georgia and Alabama ....*D. carolinus* Aubé 1838b

17'. Metepisternum and metacoxa yellow (Fig. 181G); Nova Scotia to Yukon south to Illinois and British Columbia .....5. *D. fasciventris* Say

18 (1). Frons along inner margin of eye yellow, or some specimens with yellow ring narrowly broken near inner posterior angle of eye; abdominal sterna predominantly yellow (Fig. 181J) ....8. *D. circumcinctus* Ahrens

18'. Frons dark adjacent to eye or some specimens with yellow spot over base of antenna produced shortly along anterior inner margin of eye; abdominal sterna of most specimens with expanded black marks (Fig. 181K, L) 19

19 (18). Male with apical portion of aedeagus sinuate laterally and apical knob distinct in dorsal aspect (Fig. 182T, U); female with posteromedial margin of clypeus raised above level of frons along clypeal margin; sulcate females with ridges 7 and 10 fused apically but those of 8 and 9 not fused apically; length = 29 to 40 mm ....10. *D. dauricus* Gebler

19'. Male with apical portion of aedeagus evenly curved laterally and apical knob indistinct in dorsal aspect (Fig. 182R, S); females with posteromedial margin of clypeus on same level as frons along clypeal suture; sulcate females with ridges 7 and 10 as well as 8 and 9 fused apically; length = 22 to 30 mm ......9. *D. alaskanus* J. Balfour-Browne

1. *Dytiscus verticalis* Say 1823

Fig. 181A.

Dytiscus verticalis Say 1823: 92. Type locality - eastern United States, type lost (Roughley 1990: 431).

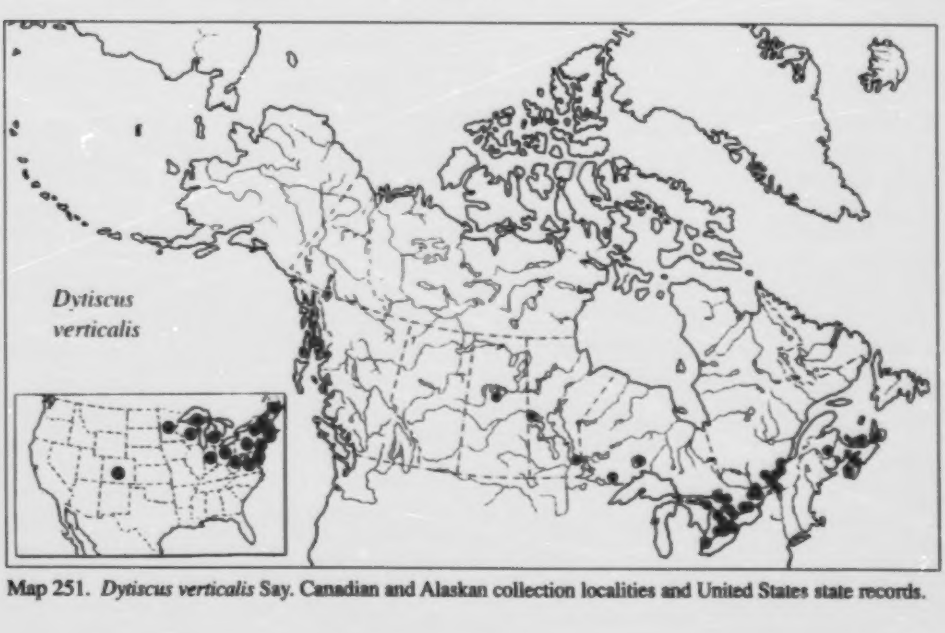
Selected References. Michael and Matta 1977: 42; Roughley 1990: 431; Hilsenhoff 1993*a*: 44.

Description. Length = 29.6 to 36.0 mm; width = 16.5 to 19.4 mm; length: width = 1.79 to 1.86. Body large and relatively broad, elytron in cross section explanate at lateral margin.

Color dark brown to black with greenish cast on some specimens; elytra and pronotum laterally broadly margined with yellow, elytron with subapical transverse fascia. Head with labrum, clypeus, anterolateral margin of frons above base of antenna and small chevron between eyes, yellow; antennomeres 1 to 3 or 4 yellow, outer antennomeres progressively darker, black apically; palpi yellow except terminal palpomere of each palpus infuscate apically; ventral surface of head yellow to dark reddish-yellow. Pronotum with lateral margins broadly bordered with yellow, apical and basal margins not or narrowly bordered with yellow. Elytron with lateral margins broadly yellow, narrow transverse subapical fascia continuous with lateral margin. Prosternum yellow. Ventral surface (Fig. 181A) with meso- and metasternum piceous, some specimens with reddish area medially on metasternum. Metacoxa piceous or with medial reddish area; metacoxal process piceous. Abdomen piceous, sterna 1 to 5 on some specimens dark reddish medially with apical and mediobasal areas piceous; sternum 6 piceous, many specimens with medial dark reddish area. Anterior leg yellow, middle leg with femur yellow to reddish, lighter than tibia and tarsus, hind leg piceous to black.

Female elytron without sulci. Female head anteromedially coarsely and densely punctate, punctures finer and sparser posteriorly; pronotum with very fine, sparse punctures medially on disc, punctures larger and denser laterally; elytron disc with very fine, sparse punctures becoming deeper and denser toward apex and intermixed with much larger and deeper punctures; metacoxa and metafemur not punctate; metatibia smooth and shiny with few widely spaced, minute punctures on ventral face. Male sculpture as above but with punctures much smaller and finer.

Head with labrum concave medially; clypeus with apical margin truncate. Metacoxal processes broadly rounded apically.



Map 251. *Dytiscus verticalis* Say. Canadian and Alaskan collection localities and United States state records.

Male protibia dorsally with anterior and posterior rows of setae bordering smooth area not clearly separated from each other dorsally; mesotarsomeres 2 and 3 uniformly setose beneath. Aedeagus with apex straight and wide pre-apically, apex acuminate in dorsal aspect and lacking an apical knob. Female sternum 6 with lateral elongate grooves and apical margin more or less produced and deeply notched medially.

Ecology. Adults and larvae occur in permanent ponds characterized by a rich diversity of emergent vascular plants (particularly cattails, *Typha* spp.) and some degree of shading. Occasionally specimens occur in sedge marshes and bogs (Hilsenhoff 1993). Larvae of *D. verticalis* prefer immature frogs and salamanders as prey (LeClair *et al.* 1986; Formanowicz and Bobka 1989).

Distribution. Map 251. The range extends from Nova Scotia to central Saskatchewan (Bow River, near Lac LaRonge, SNHM) and south to North Carolina and Colorado. It is rare in the western part of its range whereas it is abundant around the Great Lakes.

2. *Dytiscus harrisii* Kirby 1837

Fig. 181B, 182A, I

Dytiscus harrisii Kirby 1837: 76. Type locality - "taken in the Journey from New York to Cumberland House".

Selected References. Larson 1975: 397; Roughley 1990: 433; Hilsenhoff 1993*a*: 43; Larson 1997*b*: 514.

Description. Length = 32.4 to 39.0 mm; width = 16.4 to 21.9 mm; length: width = 1.78 to 1.98. Body large and relatively broad, elytron in cross section explanate at lateral margin.

Color dark brown to black with greenish cast on some specimens; pronotum and elytron laterally broadly margined with yellow, elytron with subapical transverse fascia. Head with anterolateral margin of frons above base of antenna and small chevron between eyes, reddish; antenna yellow; palpi yellow except terminal palpomere of each palpus infuscate apically; ventral surface of head yellow. Pronotum with apical, basal and lateral margins broadly bordered with yellow. Elytron with lateral margins broadly yellow, narrow transverse subapical fascia continuous with lateral margin. Prosternum pale laterally, piceous medially. Ventral surface (Fig. 181B) with mesepisternum and anterior margin of metacoxa, yellow; metacoxal process reddish; otherwise ventral sclerites of meso- and metathorax dark piceous or black. Abdomen with sternum 1 yellow medially, margins black; sterna 2 to 5 dark reddish medially with apical and laterobasal areas piceous; sternum 6 generally piceous, paler medially and apically. Anterior leg with anterior face reddish, posterior face piceous; meso- and metafemur anteriorly, trochanters and mesocoxa, reddish; otherwise middle and hind leg piceous.

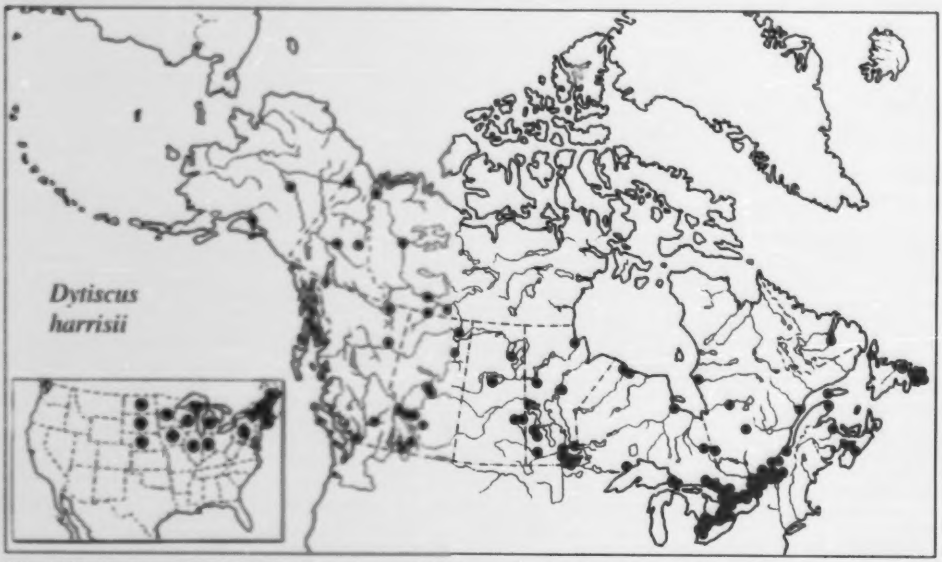
Female elytron without sulci. Female with head virtually impunctate or at most with scattered punctures along hind margin; pronotum with numerous very fine punctures scattered more or less evenly over disc; elytron distinctly punctate, small discal punctures deeper and denser toward apex and intermixed with much larger and deeper punctures; metacoxa and metafemur very finely and sparsely punctate; metatibia smooth and shiny with few widely spaced, minute punctures on ventral face. Male sculpture as above but with punctures smaller and finer.

Head with labrum only slightly concave medially; clypeus with apical margin bisinuate. Metacoxal process broadly rounded apically (Fig. 182A).

Male protibia with anterior and posterior rows of setae bordering smooth apical area clearly separated from each other dorsally; mesotarsomeres 2 and 3 uniformly setose beneath. Aedeagus (Fig. 182B) with apex only slightly deflexed and wide preapically, apex narrowly rounded in dorsal aspect and lacking an apical knob. Female sternum 6 smooth, apex not produced or deeply notched.

Ecology. Adults and larvae have been collected from shallow, warm permanent ponds and sedge marshes (Hilsenhoff 1993*a)* but specimens have also been taken in beaver ponds and from amongst emergent vegetation at the edges of slow moving boreal streams (Roughley 1990). Larvae of *D. harrisii* prefer larval Trichoptera as prey (Leclair *et al.* 1986). Adults overwinter in permanent bodies of water and disperse to breeding sites in the spring; larval development is completed by June to July.

Distribution. Map 252. The range extends from Newfoundland to Alaska south to Pennsylvania, Nebraska and Washington. It is relatively rare in the western part of its range whereas it is abundant around the Great Lakes.



Map 252. *Dytiscus harrisii* Kirby. Canadian and Alaskan collection localities and United States state records.

3. *Dytiscus hybridus* Aubé 1838

Figs. 181C; 182B, J, K

Dytiscus hybridus Aubé 1838: 116. Type locality – "États Unis d'Amérique".

Selected References. Larson 1975: 398; Michael and Matta 1977: 41 – 42; Roughley 1990: 434; Hilsenhoff 1993*a*: 43.

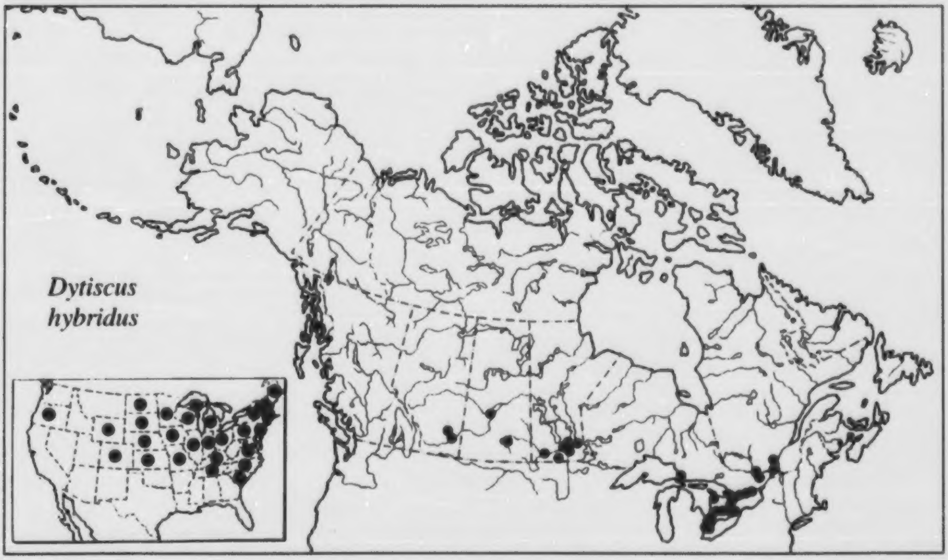
Description. Length = 24.2 to 28.1 mm; width = 12.0 to 14.0 mm; length: width = 1.89 to 2.02. Body of medium size and elongate, elytron in cross section rounded at lateral margin.

Color dark brown to black with very faint green sheen on some specimens; elytra and pronotum laterally broadly margined with yellow; elytron without subapical transverse fascia. Head with small chevron between eyes, anterior and lateral portions of frons, and frons along inner margin of eye to about level of posterior inner angle, reddish; clypeus and labrum yellow; antennomeres 1 and 2 yellow, outer antennomeres progressively darker; palpi pale except terminal palpomere of each palpus infuscate apically. Pronotum with lateral margins broadly yellow; anterior margin narrowly but distinctly bordered with yellow; basal margin piceous or on some specimens narrowly yellow. Elytron with lateral margin broadly yellow; apex irrorate with yellow. Prosternum yellow. Ventral surface (Fig. 181C) dark reddish to piceous except prothorax yellow. Anterior leg yellow, middle leg with femur yellow to piceous, lighter than tibia and tarsus, hind leg piceous.

Female elytron without sulci. Female with head finely and sparsely punctate; pronotum coarsely punctate laterally, punctures more or less confluent in form of short irregular rugae; disc medially with punctures much smaller and sparser; elytron basolaterally and apically more coarsely and densely punctate. Male with punctation sparse and fine.

Head with labrum only slightly concave medially; clypeus with apical margin truncate. Metacoxal process (Fig. 182B) broadly rounded apically.

Male protibia with anterior and posterior rows of setae bordering smooth area not clearly separated from each other dorsally; mesotarsomeres 2 and 3 with a medial longitudinal glabrous area on ventral surface. Aedeagus (Fig. 182J, K) with apex



Map 253. *Dytiscus hybridus* Aubé. Canadian and Alaskan collection localities and United States state records.

somewhat deflexed, straight and narrow pre-apically, apex produced as small rounded plate. Female sternum 6 with longitudinal grooves medially, hind margin more or less produced apically and shallowly notched medially.

Ecology. In the eastern part of its range, this species occurs in mature ponds and marshes (Hilsenhoff 1993) within the eastern deciduous forest. Further west, the habitat may be more varied as specimens have been collected from an unshaded but probably permanent, prairie pond ringed with *Typha* in Wyoming. Evidence for overwintering on land or in water is equivocal. Larval development is probably completed by July.

Distribution. Map 253. In Canada this species is known from southern Quebec west to southern Alberta. In the United States it is common from Maine to North Dakota and south to North Carolina and Nebraska. There are a few, scattered records for western states such as Wyoming, Colorado and Oregon.

4. *Dytiscus marginicollis* LeConte 1845

Figs. 181D; 182C, L

Dytiscus marginicollis LeConte 1845: 209. Type locality - "in flumine Missouri".

Selected References. Larson 1975: 398; Roughley 1990: 435.

Description. Length = 26.7 to 33.0 mm; width = 13.4 to 18.7 mm; length: width = 1.76 to 2.10. Body of medium size and elongate, elytron in cross section rounded at lateral margin.

Color reddish to black with metallic green reflection on some specimens; pronotum with all margins and elytra laterally broadly margined with yellow. Head with large medial chevron, anterior margin of frons, clypeus, labrum, palpi, ventral surface of head and on some specimens, frons medial to eye, yellow; antenna yellow basally, terminal antennomeres reddish. Pronotum with apical, basal and lateral margins broadly bordered with yellow, basal border narrowly yellow laterally, broadly and abruptly expanded medially. Elytron with yellow lateral margin narrowed toward apex and discontinuous before apex, apex irregularly irrorate with yellow. Ventral surface (Fig. 181D) varied in color; metasternum medially, posterior margin of metacoxa, metacoxal processes and abdominal sterna 2 to 6 sublaterally dark reddish to piceous; remaining portions yellow. Front and middle legs and metafemora, yellow to pale reddish; many specimens with posterior surface of tibiae, piceous; metatibia and tarsi dark reddish, except piceous medially.

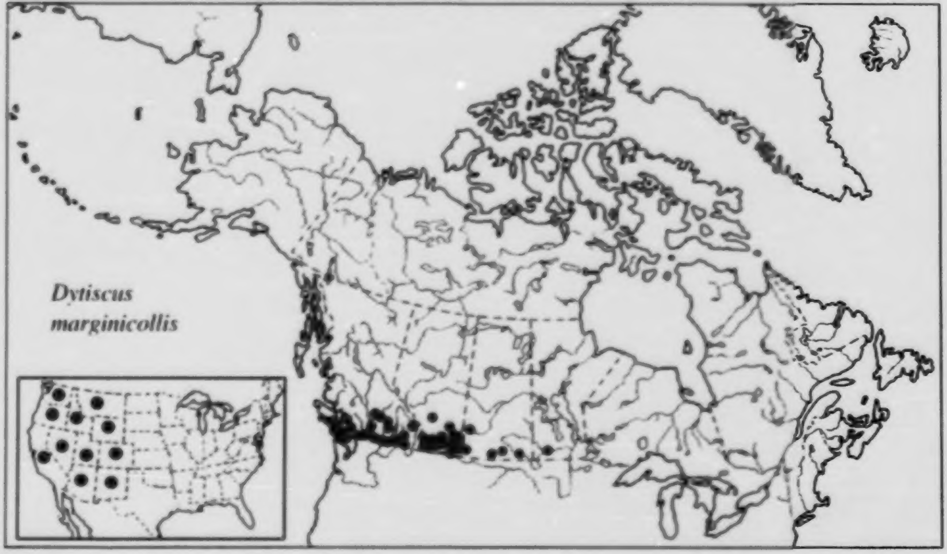
Female elytron without sulci. Female head with punctures fine and sparse; pronotum with small punctures over entire surface but on most specimens, punctation conspicuously larger and denser laterally on disc; elytron with punctation fine basally, larger and more conspicuous toward apex; punctation of ventral surface fine and sparse. Most females with system of open finely impressed anastomosing lines on basomedial portion of elytron. Male sculpture as above but with punctures fine and sparse.

Head with labrum only slightly concave medially. Metacoxal process (Fig. 182C) bluntly pointed apically, not acuminate.

Male protibia with anterior and posterior rows of setae bordering smooth area not clearly separated from each other dorsally; mesotarsomeres 2 and 3 with a medial longitudinal glabrous area on ventral surface. Aedeagus (Fig. 182L) with apex deflexed, somewhat narrowed pre-apically and apex without knob. Female sternum 6 with disc smooth, apex shallowly notched and lateral margin sinuate on either side of notch

Ecology. Many collections of this species are from semi-permanent, saline ponds in grassland areas although specimens have also been collected from permanent, non-saline ponds. Larval development is completed by May to August. In Canada this is primarily a species of grassland ponds but further south it occurs at elevations of up to 2500 m (Arizona) and is known from hot springs in Nevada and Wyoming.

Distribution. Map 254. In Canada, *D. marginicollis* ranges from Manitoba to British Columbia. To the south, easternmost records are from Montana to New Mexico with southernmost records from the states of Baja California del Norte and Durango, Mexico.



Map 254. *Dytiscus marginicollis* LeConte. Canadian and Alaskan collection localities and United States state records.

5. *Dytiscus fasciventris* Say 1824
Figs 181G; 182D, M

Dytiscus fasciventris Say 1824: 270. Type locality - "Lake Superior", type lost.

Selected References. Larson 1975: 399; Michael and Matta 1977: 41; Roughley 1990: 447; Hilsenhoff 1993*a*: 43; Larson 1997*b*: 514.

Description. Length = 22.0 to 27.9 mm; width = 11.5 to 15.0 mm; length: width = 1.80 to 2.10. Body small and relatively oval, elytron in cross section explanate at lateral margin.

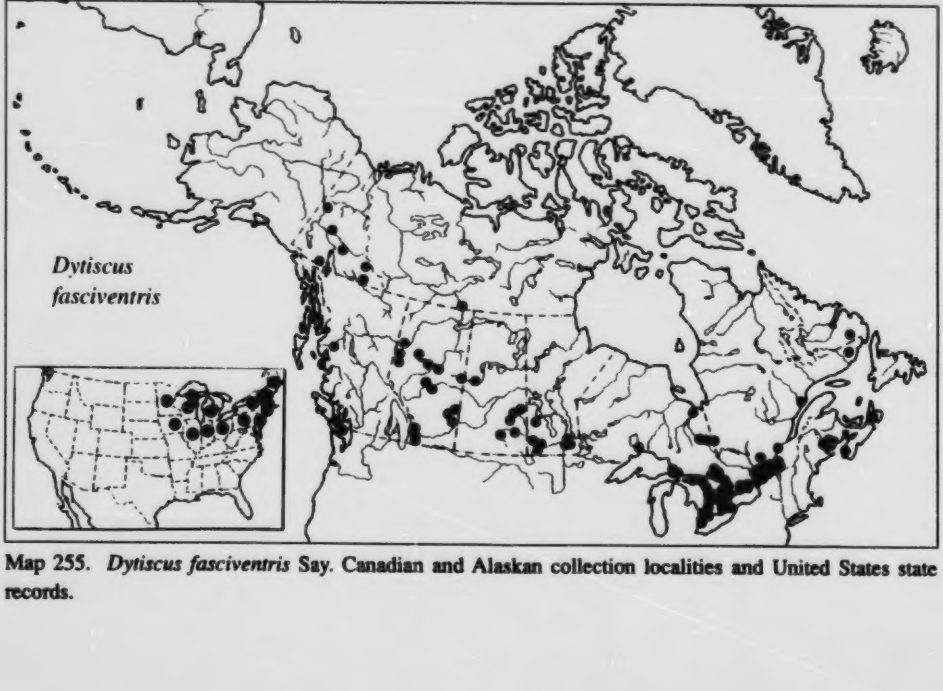
Color brown to light piceous with faint green reflection on some specimens. Head with median chevron, anterolateral angles and on some specimens, frond adjacent to inner margin of eye, reddish; antenna yellow basally, outer antennomeres darker and infuscate apically on some specimens; clypeus, labrum and ventral surface of head yellow. pronotum bordered laterally and anteriorly with yellow; basal margin colored as disc or obscurely paler, especially medially, only rarely distinctly but narrowly bordered with yellow. Ventral surface (Fig. 181G) yellow to reddish yellow except metasternum medially piceous, metacoxal process yellow; abdominal sterna with basal and apical margins piceous, basal margin with distinct mediolateral piceous spot on segments 2, 3 and on many specimens also 4 and 5, piceous spots continuous with basal margin of sternum. Legs yellow except metatibia and metatarsi darker.

Female elytron sulcate. Female with head smooth, lightly and sparsely punctate; pronotum with lateral areas densely punctate, punctures sparser and shallower medially; elytron with ridges finely punctate basally, punctures denser and intermixed with coarse punctures toward apex; metacoxa deeply punctate laterally, less strongly so medially; ventral face of metafemur strongly punctate over entire surface, punctures more or less confluent anteromedially, metatibia with ventral face micropunctate. Male dorsal surface finely punctate, elytron with apical 0.33 with relatively large and dense punctures; metacoxa finely punctate; metafemur sparsely and finely punctate on posterior half, anteromedial portion more densely punctate; metatibia finely micropunctate.

Head with labrum concave medially; clypeus with apical margin shallowly sinuate but appearing truncate. Metacoxal processes with apex broadly rounded (Fig. 182D).

Male protibia with anterior and posterior rows of setae bordering smooth area narrowly separated dorsally. Anterior protarsal claw slightly shorter than protarsomere 5. Mesotarsomeres 1 to 3 uniformly setose beneath. Aedeagus (Fig. 182M) with apex deflexed, in lateral and dorsal view slightly narrowed apically and apex without knob. Female sternum 6 depressed mediolaterally, and coarsely and irregularly rugose along posterior margin, apical margin not produced, shallowly notched medially.

Ecology. This species occurs in the northern Appalachian, Great Lakes and south to mid Boreal forest zones. James (1970) described the larval stages and commented briefly on



Map 255. *Dytiscus fasciventris* Say. Canadian and Alaskan collection localities and United States state records.

its biology in southern Ontario. Hilsenhoff (1993*a)* found *D. fasciventris* in a variety of ponds and marshes, in particular those with sedges. Flight records are from April to June and from July to November; all teneral specimens examined are from July. This species is an avid predator of early spring mosquito larvae.

Distribution. Map 255. In Canada this species occurs from Labrador and Nova Scotia west to the Yukon; there are no records from Alaska. In the United States it occurs from Maine to Minnesota and south to southern Illinois and southern Indiana.

6. *Dytiscus hatchi* Wallis 1950

Figs. 181H; 182N

Dytiscus hatchi Wallis 1950: 50. Type locality - Pond N. of Bethel, Washington.

Selected References. Hatch 1953: 237; Larson 1975: 400; Roughley 1990: 449.

Description. Length = 22.1 to 28.5 mm; width = 11.7 to 15.6 mm; length: width = 1.83 to 1.95. Body small and relatively oval, elytron in cross section explanate at lateral margin.

Color brown to light piceous with faint green reflection on some specimens. Head with median chevron, anterolateral angles and on most specimens, frons along inner margin of eye, reddish; antenna yellow basally, outer antennomeres darker and infuscate apically on some specimens; clypeus, labrum and ventral surface of head yellow. Pronotum bordered laterally and anteriorly with yellow; basal margin laterally narrowly bordered with yellow, medially yellow border expanded. Ventral surface (Fig. 181H) yellow to reddish yellow except metasternum medially piceous, metacoxal process yellow; abdominal sterna with basal and apical margins piceous, basal margin with distinct mediolateral piceous spot on segments 2 and 3 and on many specimens also 4 and 5, piceous spots not continuous with basal margin of sternum. Legs yellow except metatibia and metatarsi darker.

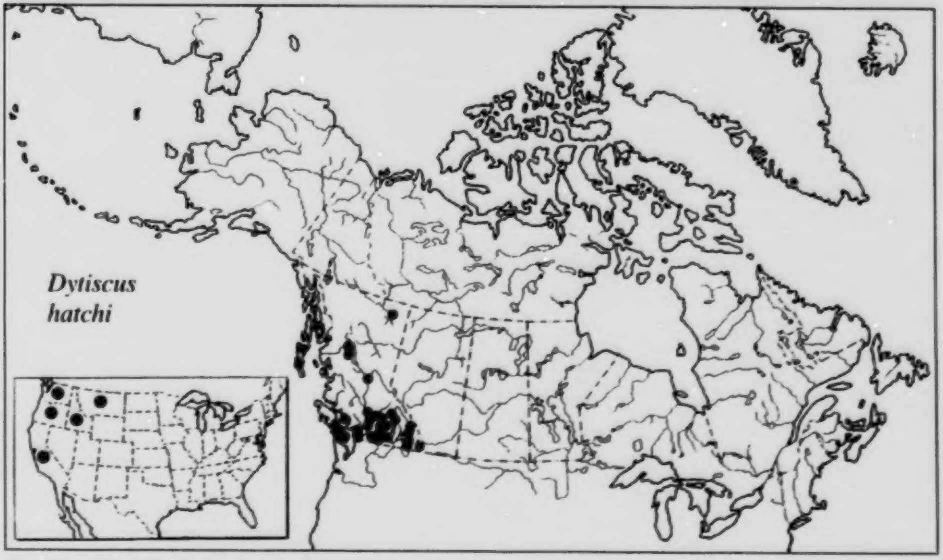
Female elytron sulcate. Female with head smooth, lightly and sparsely punctate; pronotum with lateral areas densely punctate, punctures sparser and shallower medially; elytron with ridges finely punctate basally, punctures denser and intermixed with coarse punctures toward apex; metacoxa deeply punctate laterally, less strongly so medially; ventral face of metafemur strongly punctate over entire surface, punctures more or less confluent anteromedially, metatibia with ventral face micropunctate. Male dorsal surface finely punctate, elytron with apical 0.5 to 0.67 with relatively large and dense punctures; metacoxa finely punctate; metafemur sparsely and finely punctate; metatibia finely micropunctate.

Head with labrum concave medially; clypeus with apical margin shallowly sinuate but appearing truncate. Metacoxal processes with apex broadly rounded.

Male protibia with anterior and posterior rows of setae bordering smooth area narrowly separated dorsally. Anterior protarsal claw slightly longer than protarsomere 5. Mesotarsus with tarsomeres 1 to 3 uniformly setose beneath. Aedeagus (Fig. 182N) with apex deflexed, narrowed apically in lateral and dorsal view, apex without a knob. Female sternum 6 depressed mediolaterally, and coarsely and irregularly rugose along posterior margin, apical margin not produced, shallowly notched medially.

Ecology. Specimens have been collected from amongst emergent sedges and from under partly submerged logs along the margins of beaver ponds. Like the related species, *D. fasciventris*, it occurs in forested regions and is probably an ecological replacement of *D. fasciventris*, west of the Rocky Mountains.

Distribution. Map 256. This species ranges from northern British Columbia to central California with all locality records from west of the Rocky Mountains.



Map 256. *Dytiscus hatchi* Wallis. Canadian and Alaskan collection localities and United States state records.

7. *Dytiscus cordieri* Aubé 1838

Figs. 181I; 182E, O

Dytiscus cordieri Aubé 1838*b*: 108. Type locality - Boston, Massachusetts.

Selected References. Hatch 1953: 238; Larson 1975: 400; Roughley 1990: 456; Hilsenhoff 1993*a*: 42.

Description. Length = 26.3 to 32.5 mm; width = 13.6 to 18.1 mm; length: width = 1.77 to 2.10. Body moderately large and elongate, elytron in cross section explanate at lateral margin.

Color piceous to black with green sheen on some specimens; pronotum and elytra laterally broadly margined with yellow. Head with medial chevron large, lateral arms extended to relatively large anterolateral pale areas of frons, these on some specimens extended posteriorly along inner margin of eye to about level of posterior inner angle; antennomeres 1 and 2 yellow, outer antennomeres darker, reddish; palpi, mouthparts and ventral surface of head yellow. Pronotum with all margins distinctly bordered with yellow. Elytron without subapical transverse fascia but apex irrorate with yellow. Ventral surface (Fig. 181I) entirely yellow except metasternum medially, metacoxal process and abdominal sterna slightly darker, reddish, and posterior margin of metacoxa with small elongate piceous spot. Legs yellow except meso- and metatibia, and tarsi, reddish, and pro- and mesofemora infuscate dorsally and apically on many specimens.

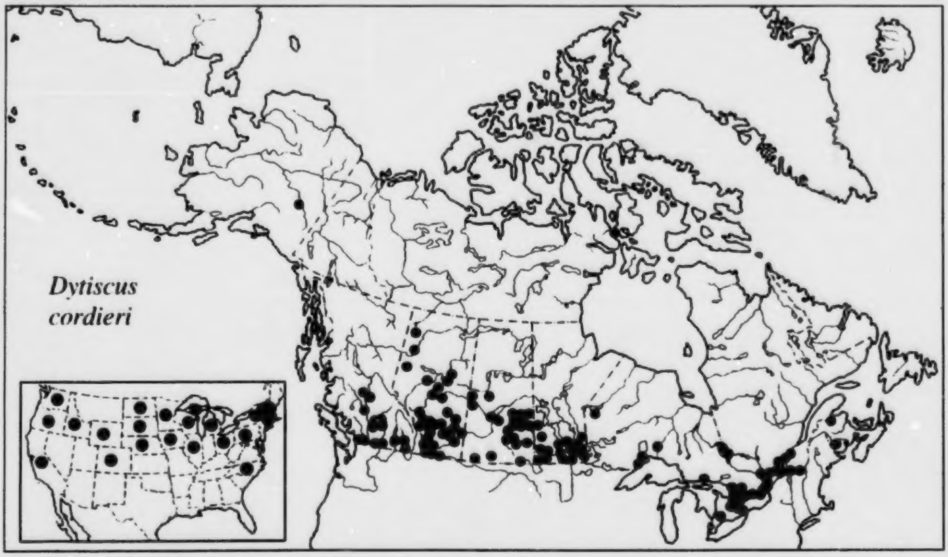
Female elytron sulcate or not; nonsulcate female with head finely and sparsely punctate, punctures best developed posteriorly on vertex; pronotum with lateral margins and lateral portions of disc with small but deep punctures, punctures finer and smaller medially; elytron basally with sparse fine punctures, larger and denser toward apex; metacoxa, metafemur and metatibia all finely and sparsely punctate. Sulcate female with similar pattern of punctation but punctures larger and more numerous. Male with punctation sparse and fine.

Head with labrum slightly concave medially; clypeus with anterior margin truncate and posterior margin arcuate, slightly raised and well delimited from frons anterior to frontal fovea, less so medially and laterally. Metacoxal process rounded apically, bluntly pointed (Fig. 182E).

Male protibia with anterior and posterior rows of setae bordering smooth area separated dorsally; mesotarsomeres 1 to 3 uniformly setose beneath. Aedeagus (Fig. 182O) with apex deflexed and pre-apical area thick in lateral aspect, apex narrowed in lateral view and lacking apical knob. Female sternum 6 with elongate grooves extending onto disc, apex not produced , shallowly notched medially.

Ecology. Specimens have been collected from permanent as well as temporary ponds and man- made habitats. These habitats generally had emergent plants and were in the open and not shaded by trees. This species seems to occur in low numbers throughout its range for series of specimens are seldom collected. Flight records are known from March to May and from July to October.

Distribution. Map 257. This is a midcontinental species with a range that extends from New Brunswick to British Columbia and south to North Carolina, Colorado and California. Single records from northern Northwest Territories and Alaska are very much outliers to the main range. They may indicate that this poorly collected species has a wider range in the north than current collection records indicate.



Map 257. *Dytiscus cordieri* Aubé. Canadian and Alaskan collection localities and United States state records.

8. *Dytiscus circumcinctus* Ahrens 1811

Figs. 181J; 182F, P, Q

Dytiscus circumcinctus Ahrens 1811: 67. Type locality - not known.

Selected References. Hatch 1953: 331; Larson 1975: 401; Roughley 1990: 477; Larson 1997*b*: 513.

Description. Length = 27.5 to 34.0 mm; width = 13.0 to 17.1 mm; length: width = 1.80 to 2.10. Body large and elongate, elytron in cross section explanate at lateral margin.

Color brown to piceous or black, with green sheen on some specimens. Head with inner margin of eye entirely ringed with yellow, or yellow narrowly broken near inner posterior angle on some specimens. Pronotum with all margins bordered with yellow. Elytron with yellow lateral margin narrowed toward apex, not or only narrowly in contact with apex, latter irrorate with yellow or some specimens with vague subapical, transverse yellow fascia. Ventral surface (Fig. 181J) reddish yellow except metasternum medially and metacoxal process, darker reddish, margins of some thoracic sclerites narrowly piceous; abdominal sterna entirely pale with basal margins of sterna 1 to 3, narrowly piceous. Legs yellow or reddish yellow except posterior dorsal surface of pro- and mesotibiae, piceous, and metatarsi infuscate.

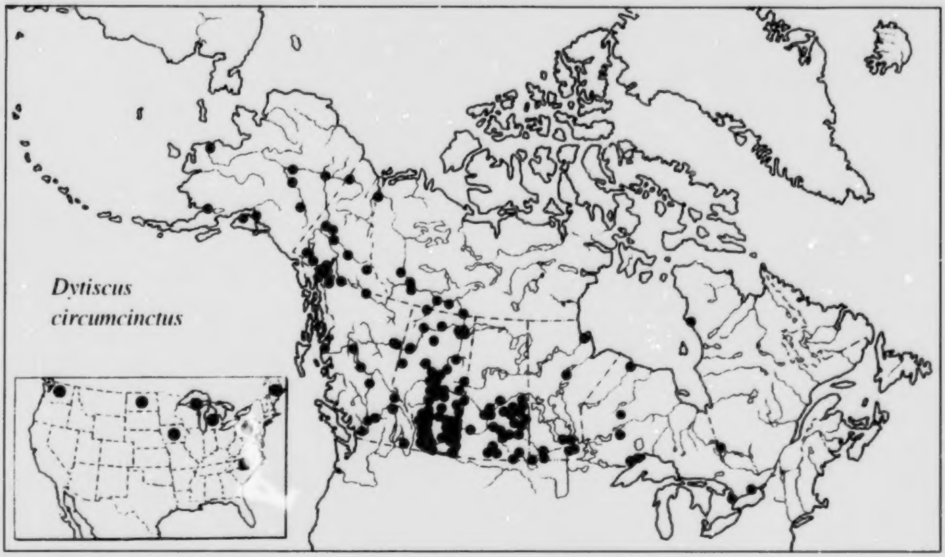
Female elytron sulcate or not. Nonsulcate female head with small deep sparse punctures medially, punctures more distinct behind; pronotum more or less evenly covered with small punctures; disc smooth and shiny medially with numerous micropunctures, dull laterally with fine reticulation; elytron with sparse fine punctures basally, punctures deeper and denser toward apex and intermixed with large coarse punctures. Sulcate female with similar pattern of sculpture but punctures much larger and denser, especially on pronotum and elytron. Male pattern of sculpture similar to that of nonsulcate female, but punctures finer and sparser.

Head with labrum concave medially; clypeus with apical margin truncate. Metacoxal process (Fig. 182F) with apex acuminate. Female with clypeus and frons on same plane or clypeus very slightly raised in form of low but sharp ridge.

Male protibia with anterior and posterior rows of setae bordering smooth area narrowly separated from each other dorsally. Mesotarsomeres 1 to 3 uniformly setose beneath. Aedeagus (Fig. 182P, Q) with apex deflexed, narrow pre-apically and with an apical knob. Female sternum 6 depressed mediolaterally and with elongate grooves on most specimens, apex not produced but deeply notched medially.

Ecology. This species occurs in a wide variety of ponds which range from temporary to permanent and from fresh-water to saline. It has a wide distribution within the boreal region but is also abundant on the prairies and occurs in the Appalachian region. Teneral specimens are known from late July.

Distribution. Map 258. This species is known from Maine to Alaska and south to North Carolina, Iowa and Washington. It is a Holarctic species and in the Palaearctic realm it is known from Kamchatka west to Great Britain.



Map 258. *Dytiscus circumcinctus* Ahrens. Canadian and Alaskan collection localities and United States state records.

9. *Dytiscus alaskanus* J. Balfour-Browne 1944

Frontispiece, Figs. 181K; 182H, R, S

Dytiscus parvulus Motschulsky 1852: 77. Type locality - Kadjak, Alaska. [not Muller 1776].

Dytiscus alaskanus J. Balfour-Browne 1944: 356. New name for *D. parvulus* Motschulsky.

Selected References. Larson 1975: 404; Roughley 1990: 481; Hilsenhoff 1993*a*: 41; Larson 1997*b*: 513.

Description. Length = 22.6 to 30.2 mm; width = 11.5 to 15.4 mm; length: width = 1.80 to 2.10. Body small to moderate and elongate, elytron in cross section explanate at lateral margin.

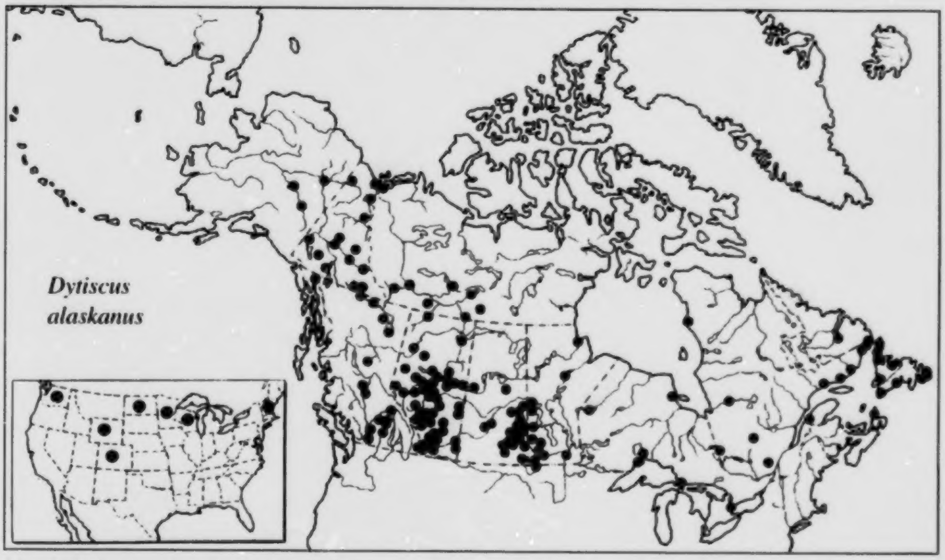
Color (Frontispiece) piceous to black, with faint green reflection on many specimens. Head with anterolateral angles above base of antenna and chevron between eyes, yellow; arms of chevron on some specimens extended to anterolateral pale areas; antenna yellow basally, outer antennomeres darker; palpi pale except terminal palpomere of each palpus infuscate; head with ventral surface yellow. Pronotum with all margins broadly bordered with yellow. Elytron with yellow lateral border not attaining apex; apex irrorate with yellow; striate female with striae yellow, ridges dark. Ventral surface (Fig. 181K) yellow except sclerites of thorax with margins narrowly black, metasternum dark rufous to piceous medially, metacoxal process reddish, abdominal sterna with basal and apical margins narrowly black, and sterna 2 and 3 each with distinct dark basolateral mark. Legs mainly yellow to reddish.

Female elytron sulcate (Frontispiece) or not. Punctation of body similar to that of *D. dauricus*. Female with disc of pronotum more or less evenly punctate. Sulcate female with ridges of sulci 7 and 10 as well as 8 and 9 fused apically to form a V within a V pattern.

Head with labrum concave medially; clypeus with apical margin truncate; frons separated from clypeus medially by distinct suture and frons and clypeus on same plane along suture, union between them smooth. Metacoxal process (Fig. 182H) with apex sharply pointed, acuminate.

Male protibia with anterior and posterior rows of setae bordering smooth area broadly separated from each other dorsally; mesotarsomeres 1 to 3 uniformly setose beneath. Aedeagus (Fig. 182R, S) with apical portion evenly curved laterally and apical knob indistinct in dorsal view. Female sternum 6 with longitudinal grooves extended onto disc on most specimens, apical margin not produced , deeply notched medially.
Ecology. This species occurs in prairie, boreal and montane zones. Specimens generally occur in permanent ponds and lakes. Aiken (1985*c*, 1986*a)* and Aiken and Williamson (1985) described aspects of the ecology of this species in George Lake, a shallow, eutrophic lake in north-central Alberta.

Distribution. Map 259. This Nearctic species is transcontinental ranging from Newfoundland to Alaska. It is known from some states along the northern parts of the conterminous United States and south to Colorado.



Map 259. *Dytiscus alaskanus* Balfour-Browne. Canadian and Alaskan collection localities and United States state records.

10. *Dytiscus dauricus* Gebler 1832

Figs. 181L; 182G, T, U

Dytiscus dauricus Gebler 1832: 39. Type locality - "le district des mines Nertschinsk, dans la Sibérie orientale".

Selected References. Larson 1975: 402; Roughley 1990: 483; Hilsenhoff 1993*a*: 42 – 43; Larson 1997*b*: 513.

Description. Length = 29.7 to 40.0 mm; width = 15.0 to 20.1 mm; length: width = 1.86 to 2.03. Body large and broadly elongate, elytron in cross section explanate at lateral margin.

Color black with green reflection on many specimens. Head with frons black along inner margin of eyes; antenna yellow basally, outer antennomeres darker reddish with distinct apical infuscation. Pronotum with all margins distinctly bordered with yellow. Elytron with marginal band narrowed behind and not quite in contact with sutural angle, apex of elytron irrorate with yellow; striate females with striae reddish or piceous, intervening ridges black. Ventral surface (Fig. 181L) predominantly reddish yellow to reddish except metasternum piceous medially, metacoxal process reddish, abdominal sterna lined with black anteriorly and posteriorly and each sternum basolaterally with piceous or black maculation, largest on sterna 2 and 3, smaller but evident on sterna 4 to 6. Legs mainly yellow to reddish.

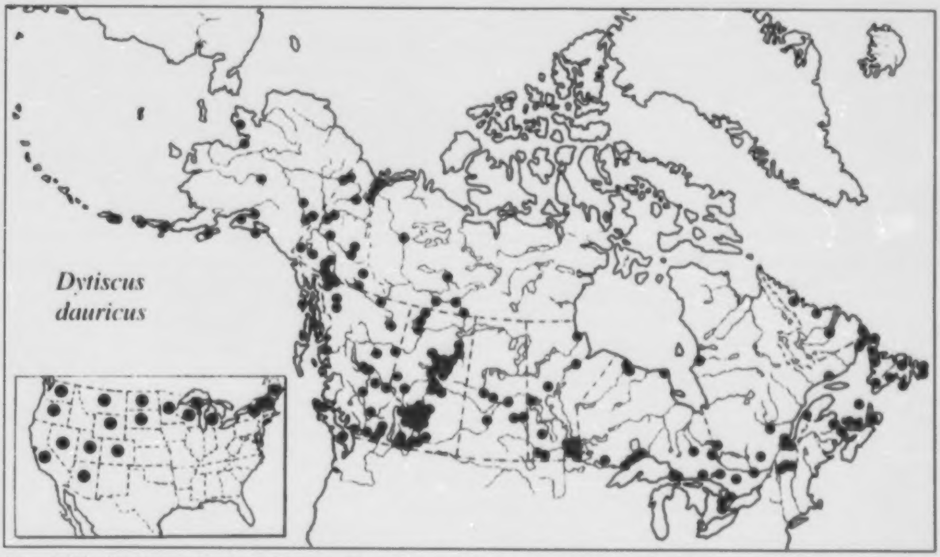
Female elytron sulcate or not. Nonsulcate female with head evenly and moderately punctate, punctures deeper and more distinct toward hind margin; disc of pronotum densely and more or less evenly punctate or with punctures somewhat sparser on mediolateral portion; disc of elytron very finely punctate basally, punctures larger and denser toward apex; metacoxa evidently but finely and sparsely punctate; metafemur with punctures fine but distinct. Sulcate female with similar pattern of punctation but punctures larger and denser on comparable portions of body; ridges of sulci 7 and 10 fused apically whereas those of sulci 8 and 9 are not fused apically. Male with punctation finer and sparser than on nonstriate female.

Head with labrum concave medially; clypeus with apical margin truncate; female with posterior margin of clypeus raised above level of frons forming a distinct ridge. Metacoxal process (Fig. 182G) with apex acuminate.

Male protibia with anterior and posterior rows of setae bordering smooth area broadly separated from each other dorsally. Mesotarsomeres 1 to 3 uniformly setose beneath. Aedeagus (Fig. 182T, U) with apical portion sinuate laterally and apical knob distinct in dorsal view. Female sternum 6 depressed mediolaterally with longitudinal grooves extended onto disc on most specimens, apical margin not produced, deeply notched.

Ecology. This species has a wide distribution in the boreal and western Cordilleran portions of the continent. It occurs primarily in permanent ponds in forested areas and is regularly found in beaver ponds. Specimens range from sea level in the north to increasingly higher elevation further south in its range. Holomuzki (1985*b*, 1986) discussed the life history in Arizona where it is a predator of larval salamanders.

Distribution. Map 260. In the northern portion of its range this species is transcontinental from Newfoundland out onto the Aleutian Island of Alaska. In the conterminous United States, *D. dauricus* is known from the northern tier of states but in the west it occurs as far south as central Arizona and California. This species also occurs in the Palaearctic region with records from the USSR mostly from east of Lake Baikal but there is also a record from northwestern China.



Map 260. *Dytiscus dauricus* Gebler. Canadian and Alaskan collection localities and United States state records.

Tribe Hydaticini Sharp 1882

Diagnosis. Moderate to large, length = 8.5 to 20 mm. Shape elongate oval, outline continuous and somewhat parallel-sided medially in many specimens; somewhat depressed but distinctly convex dorsally.

Color various, more or less uniformly reddish brown or piceous to black, many specimens with contrasting yellow to reddish markings.

Dorsal sculpture consisting of very fine, dense micropunctures and fine microreticulation, surface smooth except some females with deep strioles or rugosity on pronotum and elytra.

Clypeus with anterolateral foveae transverse and broadly separated medially; antenna and palpi normal, relatively elongate and slender. Pronotum with posterolateral angle more or less obtuse to strongly produced and acute; lateral bead absent. Prosternal process broad, almost flat to distinctly convex, bluntly pointed apically, received into broad impression on anteromedial lobe of metasternum. Metasternal wing relatively broad basally, narrow laterally with anterolateral margin straight. Metatibial spurs acuminate apically. Metatarsomeres 1 to 4 with apical margin emarginate or slightly lobed laterally, fringed with flattened yellow setae; metatarsal claws equal or unequal. Male and female metatibia and metatarsus with ventral fringe of natatorial setae.

Male protarsomeres 1 to 3 broadened to form a large oval palette which ventrally bears four transverse rows of rounded suckers. Mesotarsomeres 1 to 3 moderately expanded, ventrally with round suckers. Male genitalia with parameres symmetrical, hairless; parameres and aedeagus joined dorsally by membrane (preputial covering) within which is the epipenite sclerite (Roughley and Pengelly 1981). Female gonocoxae elongate and narrow, sclerotized, without serrations.

Comments. This tribe contains two genera, *Prodaticus* Sharp 1882*a* with two species in Africa west to India, and *Hydaticus* Leach with many species throughout the world, especially in tropical and subtropical regions.

Genus *Hydaticus* Leach 1817
Figs. 183; 184; 185.

Hydaticus Leach 1817: 69, 72. Type species - *Dytiscus transversalis* Pontoppidan, designated by Curtis 1825.

Diagnosis. Nearctic specimens of medium size, length = 10.9 to 15.4 mm. Shape (Figs. 183A; 184) oval in dorsal aspect, broadly arcuate to subparallel medially; moderately convex dorsoventrally in lateral aspect. Color various, uniformly brown to piceous without distinct pattern to black with bold yellow to red markings on pronotum and elytra.

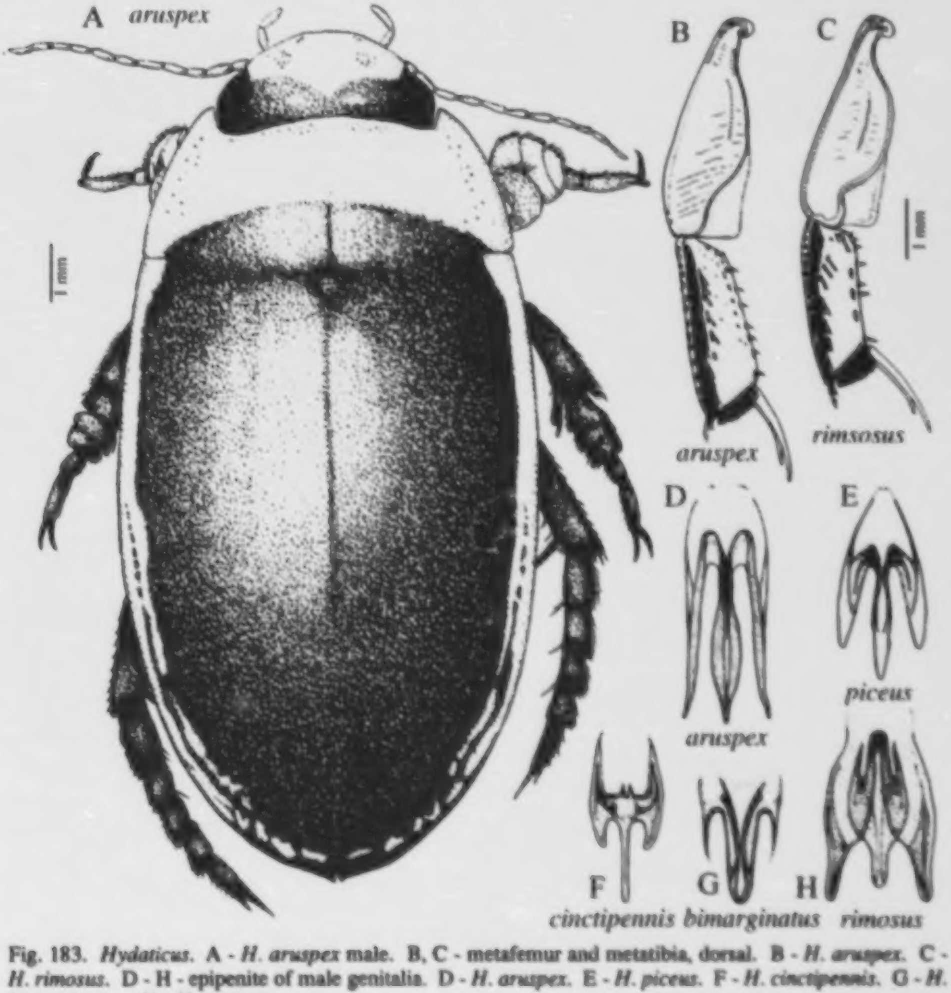


Fig. 183. *Hydaticus*. A - *H. aruspex* male. B, C - metafemur and metatibia, dorsal. B - *H. aruspex*. C - *H. rimosus*. D - H - epipenite of male genitalia. D - *H. aruspex*. E - *H. piceus*. F - *H. cinctipennis*. G - *H. bimarginatus*. H - *H. rimosus*.

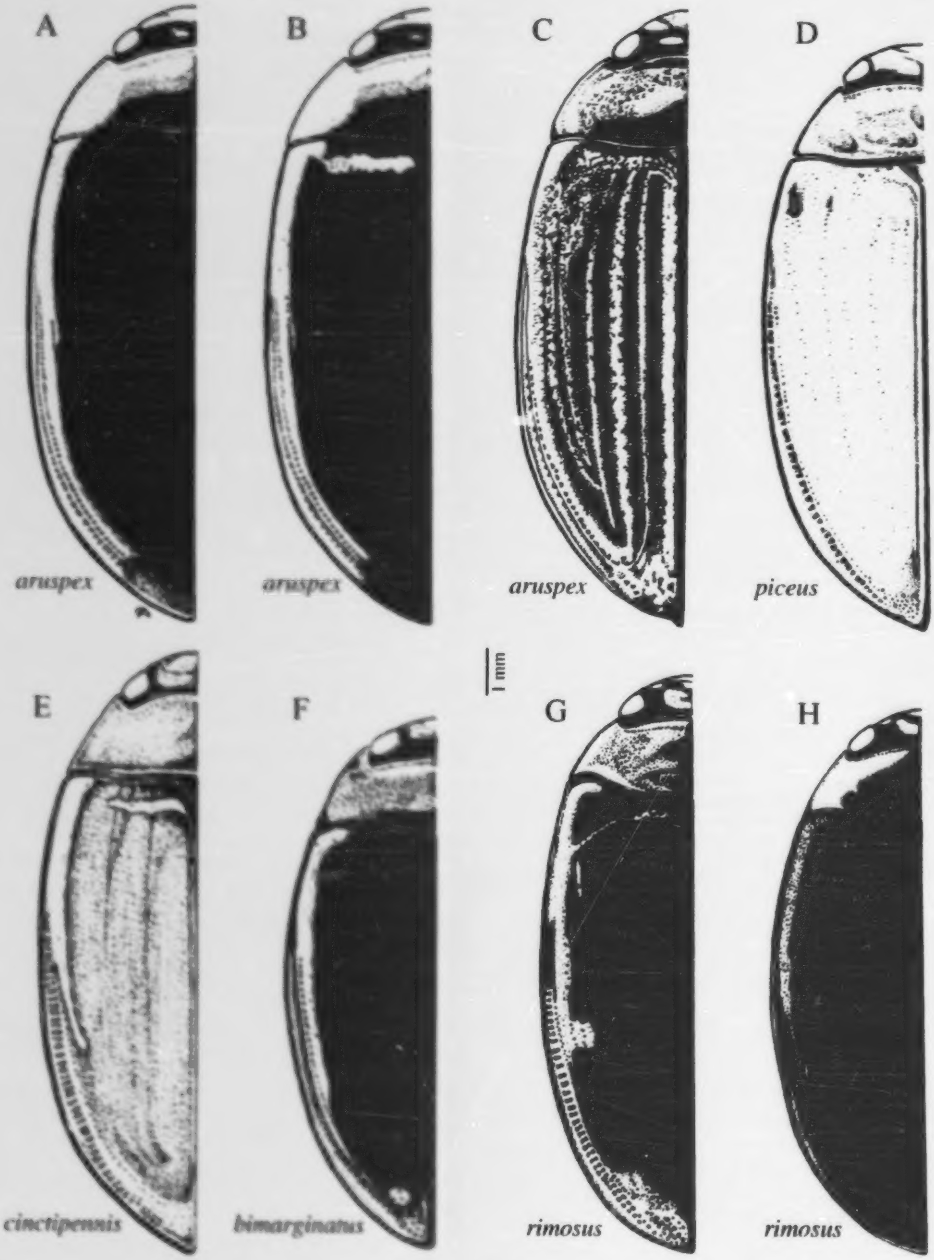

A
B
C
D
aruspex
aruspex
aruspex
piceus
1 mm
E
F
G
H
cinctipennis
bimarginatus
rimosus
rimosus

Fig. 184. *Hydaticus*, left body outline and color pattern. A, B - *H. aruspex* male. C - *H. aruspex* female. D - *H. piceus*. E - *H. cinctipennis*. F - *H. bimarginatus*. G, H - *H. rimosus*.

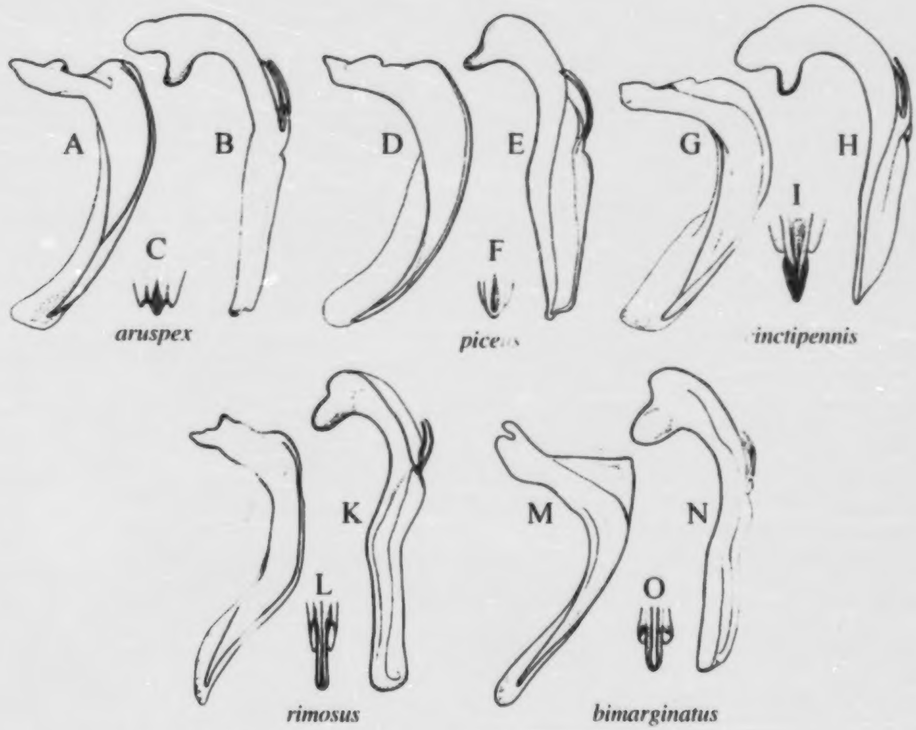


Fig. 185. *Hydaticus*, male genitalia. A - C - *H. aruspex*. A - paramere. B - aedeagus, lateral. C - aedeagus apex, ventral. D - F - *H. piceus*. D - paramere. E - aedeagus, lateral. F - aedeagus apex, ventral. G - I - *H. cinctipennis*. G - paramere. H - aedeagus, lateral. I - aedeagus apex, ventral. J - L - *H. rimosus*. J - paramere. K - aedeagus, lateral. L - aedeagus apex, ventral. M - O - *H. bimarginatus*. M - paramere. N - aedeagus, lateral. O - aedeagus apex, ventral.

Prosternal process finely margined laterally, bluntly pointed apically and broadly contacting metasternum. Metasternum with anteromedial impression shallow, not extended posterad past level of middle of mesocoxae; metasternal wings relatively broad basally, narrow laterally with external margin straight. Metacoxa large; metacoxal lines well developed posteriorly but obsolete anteriorly and generally not traceable to metasternum. Hind legs robust; metafemur without a group of setae near apicoventral angle; metatibial spurs acuminate apically, longer spur longer than length of metatarsomere 1; metatarsal claws unequal, anterior (dorsal) claw much shorter than posterior. Male and female with natatorial setae on inner and outer margins of metatibia and metatarsomeres.

Male protarsomeres 1 to 3 broadly dilated (Fig. 183A), together bearing four rows of four, five, seven and six adhesive scales on ventral surface; mesotarsomeres 1 to 3 moderately dilated with rows of three, four and four adhesive scales on ventral surface; protarsomere 2 dorsally with transverse rows of coarse punctures across which moveable spines of apex of protibia can be drawn (a putative stridulatory organ (Larson and Pritchard 1974)). Parameres symmetrical, without setae on ventral margin, subequal in length to aedeagus, joined dorsally by membranous covering on which are placed an elongate, rod-like spicule and apical W-shaped epipenite (Fig. 183D – H); aedeagus with laterally directed membranous flanges. Female ovipositor with gonocoxa elongate, knife-shaped and without setae or spines.

Comments. The tribe Hydaticini is composed of two genera: *Prodaticus* Sharp with two species in the Oriental and Ethiopian regions (Rocchi 1976); and *Hydaticus*, with about 200 species worldwide including North America. The defining feature of members of Hydaticini is the straight anterolateral margin of the metasternal wing. A protibia-protarsomere 2 stridulatory organ occurs on all species of *Hydaticus* examined except for a lotic African species. It is not known if this organ occurs on male *Prodaticus*. The precise relationship between the protibial pegs and the protarsomere 2 pits is highly suggestive that this is a stridulatory organ but more than 25 years after this function was proposed by Larson and Pritchard (1974) there is still no direct observation of sound production.

Roughley and Pengelly (1981) discussed the classification of the five North American species of *Hydaticus* Leach. Externally these beetles are quite uniform in size and shape. However, the form of the expanded pro- and mesotarsi of the male and modifications of the male genitalia provide many interesting, yet not fully explored, characters for classification and phylogeny.

North American species are lentic, inhabiting shallow, vegetation-rich margins of usually rather eutrophic ponds and small lakes. They tend to occur in shallower and more densely vegetated water than do other members of Dytiscinae, as documented by Larson (1997*c*).

Key to species of *Hydaticus* of North America

(modified from Roughley and 1981)

1. Pronotum with posterolateral angle produced and distinctly acute Fig. 184F – H), posterior margin broadly sinuate and recurved lateral to basomedial lobe; metatibia with row of spines on disc of posterior (upper) surface curving inwards basally, not parallel to outer tibial margin (fig. 183C); male genitalia with epipenite (Fig. 183G, H) at apex of preputial covering ....subgenus *Guignotites* Brinck 1943, 2

1'. Pronotum with posterolateral angle not strongly produced, more or less right angled in dorsal aspect, posterior margin indistinctly sinuate and not recurved lateral to basomedial lobe (Fig. 183A, 184A – E); metatibia with row of spines on posterior (upper) surface straight, parallel to outer tibial margin Fig. 183B); male genitalia with epipenite (Fig. 183D – F) anterior to apex of preputial covering ....subgenus *Hydaticus* s. str., 3

2(1) Aedeagus in lateral aspect with apex angulate (Fig. 185N); metatibia ventral face with 9 to 14 large setae; pronotum with basal black band restricted to basal third on most specimens, on some extended to anterior margin; sublateral stripe of elytron without inward extension near middle, subbasal transverse fascia absent (Fig. 184F); length = 10.9 to 13.1 mm; New York south to Texas, Florida, Cuba and Bahamas ....*H. bimarginatus* (Say 1831)

2'. Aedeagus in lateral aspect with apex truncate (Fig. 185K); metatibia ventral face with 2 to 10 large setae (Fig. 183C); pronotum with basal black band extended to or almost to anterior margin on most specimens; sublateral stripe of elytron sometimes with inward extension near middle, subbasal transverse fascia present on some specimens (Fig. 184G, H); length = 11.1 to 13.7mm; Mexico, Carribean Islands, and Bahamas .... *H. rimosus* Aubé 1838*b*

3 (1). Color black; frons black with a pair of sharply defined yellow to reddish frontal spots; elytron with sharply delimited yellow lateral margin (Figs. 183A; 184A – C); length = 12.4 to 15.4 mm .... 1. *H. aruspex* Clark

3'. Color reddish-brown; frons rufous to brownish and frontal spots poorly defined; elytron with or without delimited pale lateral margin (Fig. 184D, E) 4

4(3). Elytron without delimited yellow lateral margin, lateral margin pale and gradually darkened onto disc; subbasal transverse fascia absent (Fig. 184D); aedeagus in lateral aspect with apical projection (Fig. 185E); length = 11.6 to 14.0 mm .... 2. *H. piceus* LeConte

4'. Elytron with lateral yellow margin sharply defined, at least on basal half; subbasal transverse fascia present or absent (Fig. 184E); aedeagus in lateral aspect with apex angulate (Fig. 185H); length = 12.8 to 14.7 mm; New York and Massachusetts south to Florida .... *H. cinctipennis* Aubé 1838*b*

1. *Hydaticus aruspex* Clark, 1864

Figs. 183A, B, D; 184A–C; 185A – C.

Hydaticus aruspex Clark 1864: 212.

Hydaticus modestus Sharp 1882*a*: 650. Type locality - "Am. bor.". Type in BMNH

Selected References. Larson 1975: 405 (as *H. modestus* Sharp); Roughley and Pengelly 1981: 260 (as *H. modestus*); Nilsson 1981*b*: 104; Hilsenhoff 1993*a*: 50; Nilsson and Holmen 1995: 153 – 154; Larson 1997*b*: 514.

Description. Length = 12.4 to 15.4 mm; width = 6.6 to 8.0 mm; length: width = 1.81 to 1.97. Body (Figs. 183A; 184A – C) elongate oval and moderately convex in lateral view.

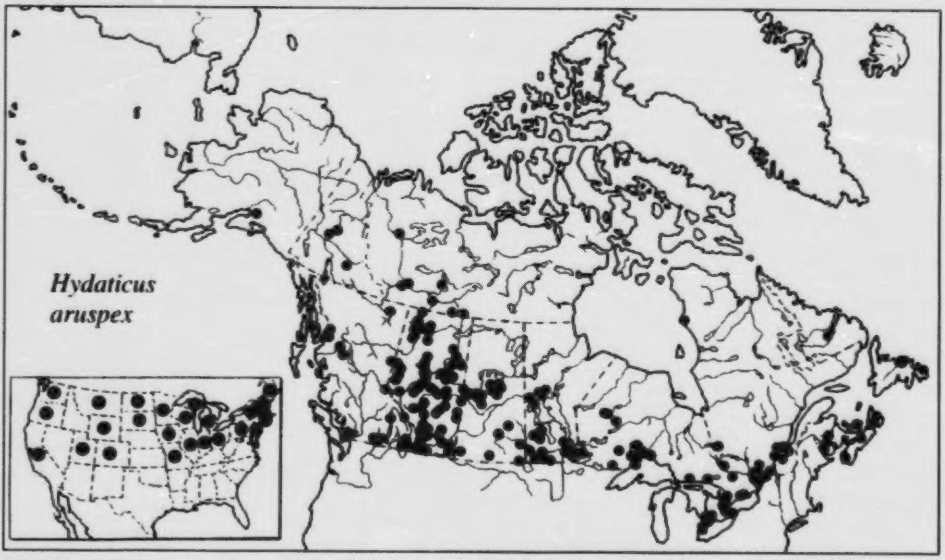
Color (Figs. 183A; 184A – C) black with various amounts of yellow markings. Head dorsally black except labrum, clypeus, anterior portion of frons and frontal spots between eyes, yellow; head ventrally yellowish; antenna yellow except outer antennomeres infuscate; palpi pale. Pronotum rufous except broad piceous to black band along basomedial margin. Scutellum piceous. Male elytron with lateral margin broadly yellow, some specimens also with a narrow transverse, sub-basal pale fascia. Female elytron colored as male or some specimens with one to five longitudinal vittae on disc. Ventral surface piceous to black except epipleuron and prosternum, testaceous to rufous, and abdominal sterna 2 to 5 each with small lateral testaceous to rufous spot. Pro- and mesofemur rufous, remainder of legs dark brown to black.

Male elytron, other than serial punctures, with coarsest punctures small and shallow, interspaces very finely but densely micropunctate and entire disc with fine isodiametric sculpture. Female elytron with sculpture dimorphic, similar to that of male or with deep irregular grooves (rugosity) variously developed on basal and lateral portions of elytron or all of disc rugose and also on lateral portion of pronotum. Elytron apex slightly produced, most strongly so on female.

Male genitalia (Figs. 183D; 185A – C) with aedeagus in lateral aspect with apex notched.

Ecology. There is evidence that *H. aruspex* may overwinter on land (Roughley and Pengelly 1981; Hilsenhoff 1993*a)* in forest debris or litter. Adults disperse in spring presumably to early spring, temporary feeding sites and later to more permanent, woodland ponds. They breed in permanent ponds characterized by deep detritus, emergent aquatic vascular plants and often some degree of shading by surrounding forest. Hilsenhoff (1993*a)* has taken larvae and adults in a wide variety of aquatic sites in Wisconsin. Autumnal dispersal records are for relatively late in the season (September) but Canadian records (southern Ontario) for teneral specimens are all from July indicating that adults may remain in the permanent ponds until moving to overwintering sites. Hilsenhoff (1993*a)* suggested that there might be a partial second generation in late summer. The mature larval stage of this species was described by Watts (1970, as *H. stagnalis* Fab.) and it is keyed by Hilsenhoff (1993*a)*.

Distribution. Map 261. The Nearctic range of this Holarctic species extends from Newfoundland and Labrador to British Columbia and Alaska. It reaches about the northern limit of the boreal zone and extends south to Pennsylvania, Missouri, Colorado and northern California. In the Palaearctic region the species occurs across Siberia to Fennoscandia (Nilsson 1981*b)*.



Map 261. *Hydaticus aruspex* Clark. Canadian and Alaskan collection localities and United States state records.

2. *Hydaticus piceus* LeConte, 1863

Figs. 183E; 184D; 185D – F.

Hydaticus piceus LeConte 1863: 23. Type locality - Illinois.

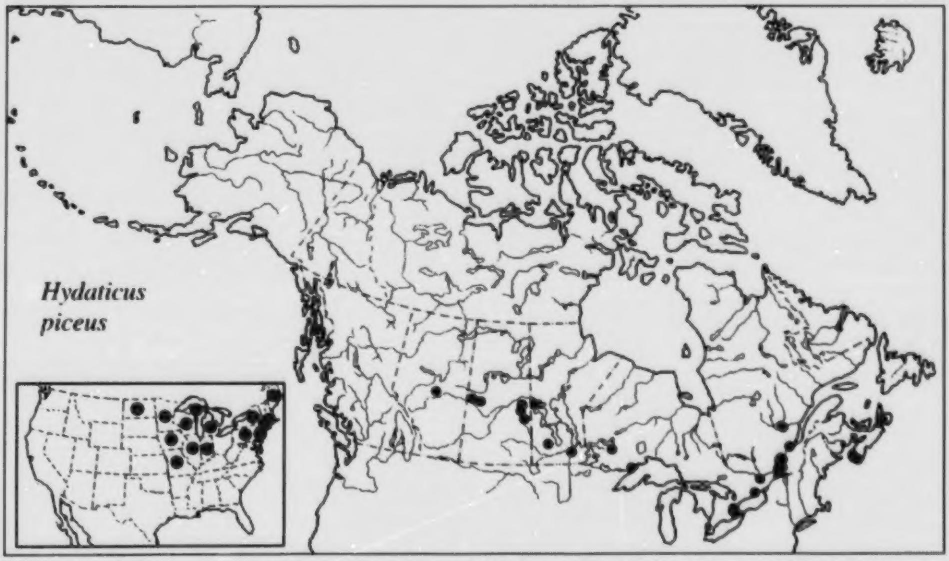
Selected References. Roughley and Pengelly 1981: 267; Hilsenhoff 1993*a*: 50.

Description. Length = 11.6 to 14.0 mm; width = 6.6 to 7.9 mm; length: width = 1.77 to 1.83. Body (Fig. 184D) oval and somewhat depressed in lateral view.

Color (Fig. 184D) dark reddish brown to light piceous. Head dorsally yellow to brown, darker posteriorly, frons indistinctly and variously darkened, frontal spots indistinct; head ventrally brown with gula lighter than genae; antenna and palpi yellow. Pronotum yellow to dark brown, paler laterally, disc with irregular darker blotches. Scutellum brown. Elytron yellowish to dark reddish-brown, with small isolated irrorations basally and laterally, paler laterally but without delimited lateral stripe. Ventral surface piceous to black except epipleuron and prosternum, yellow to rufous, and abdominal sterna 2 to 5 each with small lateral testaceous to rufous spot. Pro- and mesofemur yellowish, remainder of legs darker, light brown to piceous, hind legs piceous to black.

Male elytron with coarsest punctures small and shallow, interspaces very finely and densely micropunctate and entire disc with fine isodiametric sculpture. Female elytron with sculpture dimorphic, similar to that of male or with deep irregular grooves (rugosity) variously developed on basolateral portion of elytron and also on lateral portion of pronotum.

Elytron with apex rounded in both sexes.



Map 262. *Hydaticus piceus* LeConte. Canadian and Alaskan collection localities and United States state records.

Male genitalia as in Figs. 183E; 185D – F, aedeagus in lateral aspect with a narrow ventral projection at apex.

Ecology. In eastern Canada this species is primarily a resident of shaded, deciduous woodland pools with a diversity of emergent aquatic vascular plants and organic substrate. In western Canada it is found in the aspen parkland zone and probably in the same general habitat. Flight records are known for June and July. The mature larva is keyed by Hilsenhoff (1993).

Distribution. Map 262. This Nearctic species is known from Nova Scotia west to central Alberta and south to southern Pennsylvania and central Illinois.

Tribe Aciliini Thomson 1867

Diagnosis. Dytiscinae of moderate size, length = 7.5 to 17 mm. Body broadly oval, widest behind middle, dorsoventrally flattened; body outline continuous in dorsal aspect.

Color various, most specimens with dorsal surface yellow to reddish with dark maculations; ventral surface yellow to black.

Sculpture various, elytra with dense punctation of various size, punctation evident to very fine and inconspicuous.

Pronotum with posterolateral angles slightly to strongly produced and acute; lateral bead absent. Prosternal process flat to slightly and broadly convex, broadly rounded apically. Metasternum with anteromedial lobe broadly flattened or impressed; metasternal wing generally narrow, with anterolateral margin arcuate. Metacoxa very large. Metatibia short and broad, metatibial spurs finely emarginate apically; metatarsomeres 1 to 4 each with apical margin lobed or emarginate, dorsally fringed with flattened, yellow setae; metatarsal claws unequal. Metatibia and metatarsomeres bearing natatorial setae on posterior faces of both males and females.

Male protarsal palette (Fig. 187A – D) ventrally with 3 large round basal discs and a variable number of smaller round adhesive discs or fields of small adhesive setae; mesotarsomeres ventrally with adhesive discs, tufts of setae or not modified. Genitalia with parameres slender, symmetrical, with short setae apically; dorsal membrane without apical sclerite. Female gonocoxae long and slender, lightly to rather strongly sclerotized, apex bluntly to narrowly rounded and with a setal pencil.

Comments. Three of the seven genera assigned to this tribe occur in North America and are represented in Canada. These insects are strong swimmers and can be observed frequently sculling about in the open water of ponds and lake margins. Several species occur principally in peatland ponds, often in strongly stained brown water. The larvae are also capable swimmers and are more or less pelagic, hovering in open water through sculling movements of the legs and striking with their heads at larger zooplankton. When disturbed, larvae flick their abdomens down and shoot backwards rapidly.

Genus *Acilius* Leach
Figs. 186; 187.

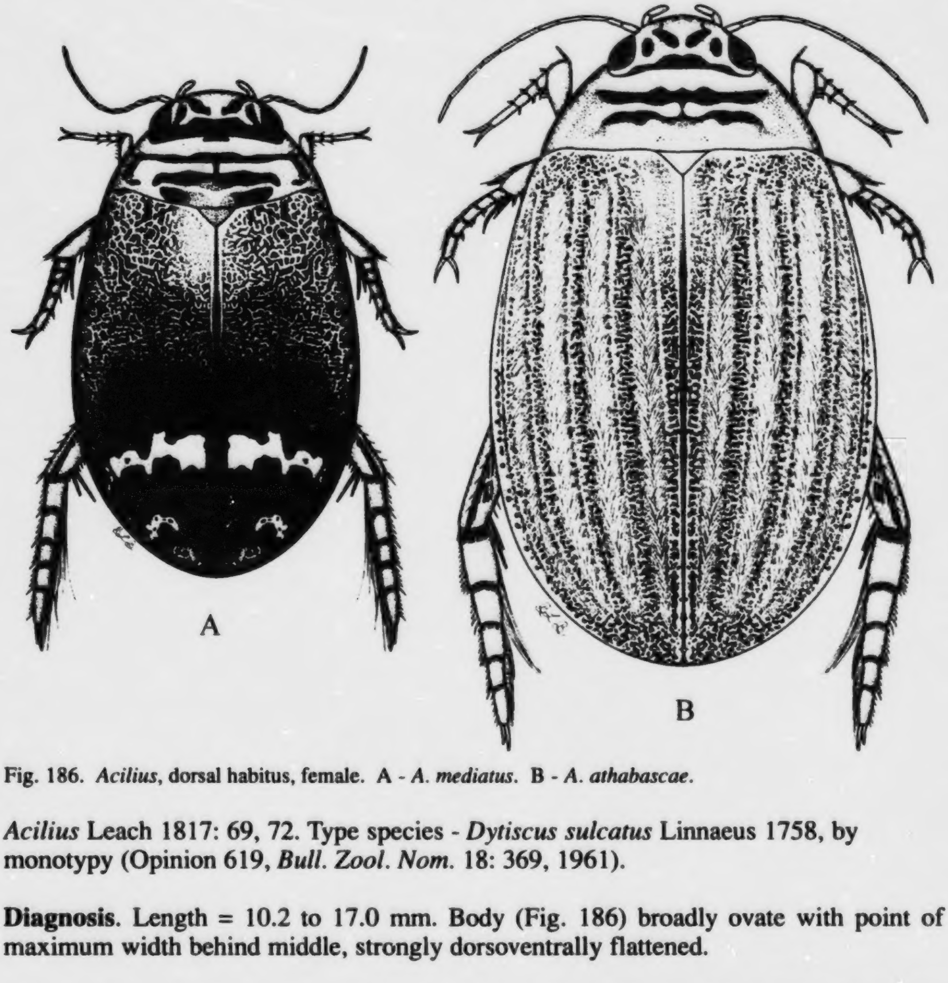


Fig. 186. *Acilius*, dorsal habitus, female. A - *A. mediatus*. B - *A. athabascae*.

Acilius Leach 1817: 69, 72. Type species - *Dytiscus sulcatus* Linnaeus 1758, by monotypy (Opinion 619, *Bull. Zool. Nom.* 18: 369, 1961).

Diagnosis. Length = 10.2 to 17.0 mm. Body (Fig. 186) broadly ovate with point of maximum width behind middle, strongly dorsoventrally flattened.

Dorsal surface yellow with dark markings (Fig. 186); pronotum with an anterior and a posterior transverse black band which are separated from both anterior and posterior margins, respectively; anterior band laterally produced back and contacting lateral arm of posterior band in many specimens; elytron with variously confluent black irrorations, darkest in front of and behind a more or less evident transverse subapical pale fascia. Ventral surface yellow to black.

Dorsal surface strongly punctate with intermixed coarse (subequal in size to serial punctures) and fine punctures. Females of most species with elytron bearing four broad, longitudinal sulci (Fig. 186B), sulci bearing elongate, suberect setae.

Mesofemur basally with posteroventral margin bearing five or six elongate setae which are shorter than width of mesofemur at their base. Metacoxal lines evident posteriorly but becoming obsolete on metacoxal plate and not traceable to metasternum.

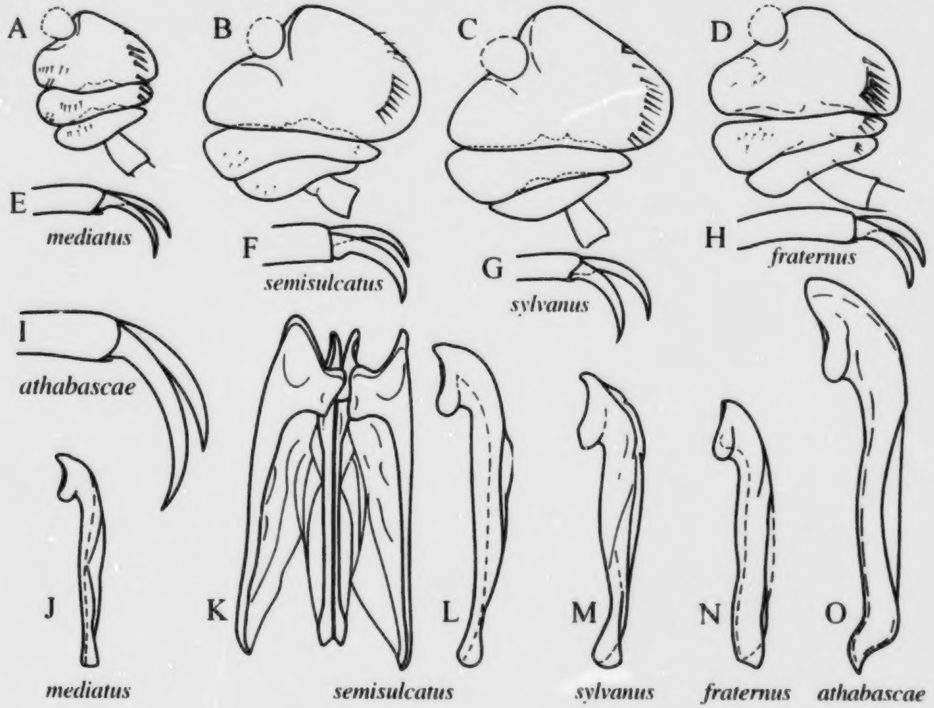


Fig. 187. *Acilius*. A - D - male protarsal palette, dorsal. A - *A. mediatus*. B - *A. semisulcatus*. C - *A. sylvanus*. D - *A. fraternus*. E - I - male protarsal claws, anterior. E - *A. mediatus*. F - *A. semisulcatus*. G - *A. sylvanus*. H - *A. fraternus*. I - *A. athabascae*. J - O - male genitalia. J - *A. mediatus* aedeagus, lateral. K, L - *A. semisulcatus*. K - parameres and aedeagus, ventral. L - aedeagus lateral. M - *A. sylvanus* aedeagus, lateral. N - *A. fraternus* aedeagus, lateral. O - *A. athabascae* aedeagus, lateral.

Male protarsal palette (Fig. 187A – D) ventrally bearing 3 large discs and two dense fields of small adhesive hairs; mesotarsomeres 1 to 3 various, unmodified, each with an elongate apically directed tuft of setae on posteroventral angle, or with tuft of setae and a few small adhesive setae. Female ovipositor very elongate, tube-like.

Comments. This is a small genus of Holarctic distribution. No species is known to be common to the Old and New Worlds. The Nearctic species generally occur in forested regions and in aggregate range from boreal to mid-temperate latitudes.

Hilsenhoff (1975) reviewed the eastern North American species. We recognize six species but it is possible that *A. simplex* LeConte 1851 (described from California) is a valid species, *Acilius abbreviatus* may be only a regional form of *A. semisulcatus*, and the limits between *A. semisulcatus* and *A. fraternus* are not well understood. The genus needs revision. Wolf (1980) discussed the larvae and Hilsenhoff (1993*a)* gave a key to the larvae of the four species of the eastern United States.

Hilsenhoff (1993*a)* reported that the four Wisconsin species are univoltine. Adults overwinter in permanent waters and disperse in the spring to a variety of habitats where mating and egg laying occur. Larvae complete development during spring and early summer. This pattern suggests that adults migrate to overwintering sites. We have found *A. semisulcatus* in southern Ontario breeding in vernal ponds supporting this type of seasonal movement. However, *A. mediatus* and *A. athabascae* are constantly in permanent habitats as is *A. semisulcatus* in the boreal and western parts of its range where no evidence of seasonal migration to overwintering sites has been observed.

Key to species of *Acilius* of North America

1. Size small, length = 10.2 to 12.5 mm; elytron with subapical pale fascia distinct with disc anterior and posterior to fascia black; hind legs largely piceous to black; female elytron lacking longitudinal sulci (Fig. 186A) .... 1. *A. mediatus* Say

1'. Larger, length = 12.0 to 17.0 mm; elytron with subapical fascia variously developed, from indistinct to sharply limited by black; color of hind legs various, entirely yellow to black; female elytron sulcate (Fig. 186B) or not 2

2(1). Ventral surface of body entirely yellow to reddish, without expanded piceous or black markings 3

2'. Ventral surface of body variously maculate, metasternum and metacoxal plate largely black, abdominal sterna dark rufous to piceous at least mediobasally 5

3(2). Pronotum with numerous infuscate punctures in addition to dark discal fasciae making lateral and basal portions of disc more or less irrorate (Fig. 186B); male aedeagus (Fig. 187O) with apex raised into a crest in lateral aspect; female elytron with all sulci beginning close to base (Fig. 186B), sulcal hairs elongate and yellow .... 6. *A. athabascae* Larson

3'. Pronotum with discal fasciae well defined, punctures adjacent to fasciae not infuscate and pale areas of disc not irrorate; male aedeagus apex not crescent-shaped in lateral aspect (Fig. 187 J – N); female elytron with sutural sulcus beginning more posteriorly on disc than other sulci, sulcal hairs yellow to brown 4

4(3). Elytron with subapical pale fascia obscure, either not evident or appearing as a broad transverse area of less dense irroration; male protarsal claws scarcely differing, anterior claw only slightly broader than posterior; female elytron with sulci broadly separated from base, distance between base of elytron and anterior limits of anterormost sulci greater than length of pronotum; east of Great Plains .... 4. *A. sylvanus* Hilsenhoff

4'. Elytron with subapical fascia various but visible on most specimens as a narrow pale or sparsely irrorate band, fascia slightly broadened and projected anteriorly just laterad of suture; male anterior protarsal claw evidently longer and broader than posterior; female with anteromost sulci almost attaining elytral base and beginning less than one-half length of pronotum behind base; western, west of Great Plains .... 3. *A. abbreviatus* Mannerheim (in part)

5(2). Elytron with punctures more or less rounded; male protarsomere 1 more narrowly rounded, protarsal claws barely differing, mesotarsomeres 1 to 3 without distinct tuft of setae on apicoventral angle; female elytron lacking sulci; metafemur largely or entirely piceous to black .... 5. *A. fraternus* Harris

5'. Elytron with punctures distinctly crescentic, anterior margin of each truncated; male protarsomere 1 with posterior margin more broadly rounded, anterior protarsal claw distinctly broader than posterior, mesotarsomeres 1 to 3 each with a tuft of elongate setae on apicoventral angle; female elytron sulcate; metafemur of most specimens largely testaceous to rufous although some specimens with metafemur infuscate 6

6(5). Subapical fascia of elytra with anterior margin more or less evenly curved; male anterior protarsal claw broader and more arcuate than posterior; female elytron with sulci starting well posterad of base, on most specimens distance from base to start of most anterior sulcus subequal to two-thirds or more medial length of pronotum; transcontinental, boreal .... 2. *A. semisulcatus* Aubé

6'. Subapical fascia of elytra broadened and produced anteriorly sublaterally to sutural margin, its anterior margin not forming an even curve across combined apices of elytra; male anterior protarsal claw narrower, more or less similar to posterior; female with sulci extending almost to base of elytron, separated from base by a distance less than one-half medial length of pronotum; west of Great Plains .... 3. *A. abbreviatus* Mannerheim (in part)

1. *Acilius mediatus* (Say 1823)

Figs. 186A; 187A, E, J.

Dytiscus mediatus Say 1823: 93. Type locality - not given.

Selected References. Hilsenhoff 1975: 273; Michael and Matta 1977: 46 – 47; Hilsenhoff 1993*a*: 38.

Description. Length = 10.2 to 12.5 mm; width = 5.8 to 6.8 mm; length: width = 1.70 to 1.80. Smallest species of *Acilius*,

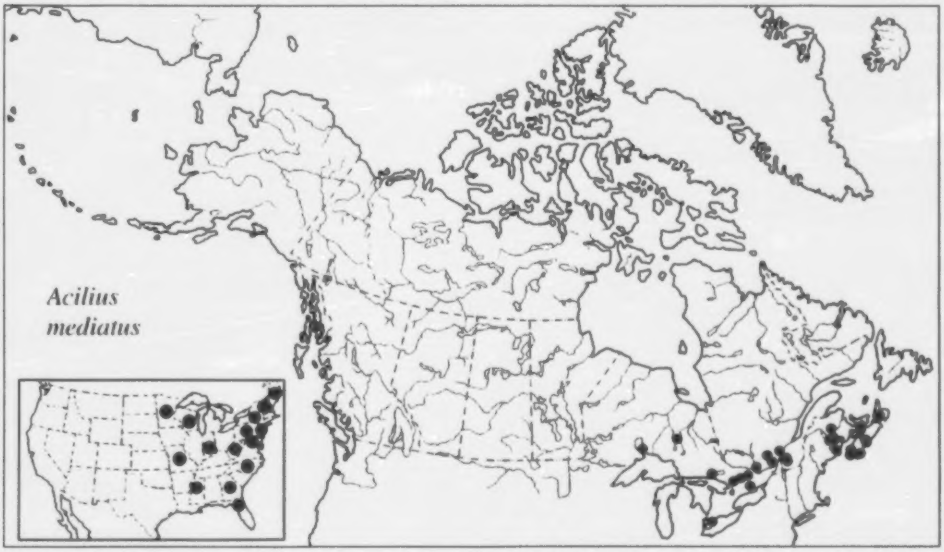
Color as in Fig. 186A. Head reddish yellow with posterior margin and a more or less complete inverted M-shaped mark on frons between eyes, piceous. Pronotum with a pair of medial transverse black markings, on most specimens these connected laterally. Elytron irrorate basally, maculations denser apically and on apical half fused to form a black area broken by transverse subapical yellow fascia and several irregular apical yellow spots. Ventral surface largely black, front and middle legs reddish, hind legs dark reddish to black.

Elytron with small rounded punctures of somewhat varied size; interspaces minutely micropunctate.

Male protarsomere 5 short; protarsal claws (Fig. 187A, E) similar in shape; mesotarsomeres 1 to 3 lacking tufts of elongate setae on apicoventral angle; aedeagus (Fig. 187J) in lateral aspect slightly broadened at apex, apex almost truncate. Female elytron nonsulcate.

Ecology. This species occurs in small forest pools, generally those with bare, peaty bottoms. Also, specimens have been collected frequently from pools in or adjacent to small, slow flowing brown-water streams.

Distribution. Map 263. The species has a wide range in eastern North America, from Nova Scotia to southern Ontario, and south to Florida.



Map 263. *Acilius mediatus* (Say). Canadian and Alaskan collection localities and United States state records.

2. *Acilius semisulcatus* Aubé 1838

Fig. 187B, F, K, L.

Acilius semisulcatus Aubé 1838*b:* 132. Type locality - United States.

Selected References. Hilsenhoff 1975; Larson 1975: 409 – 410; Michael and Matta 1977: 47; Hilsenhoff 1993: 38 – 39; Larson 1997*b*: 514.

Description. Length = 12.5 to 15.6 mm; width = 7.2 to 8.6 mm; length: width = 1.70 to 1.82.

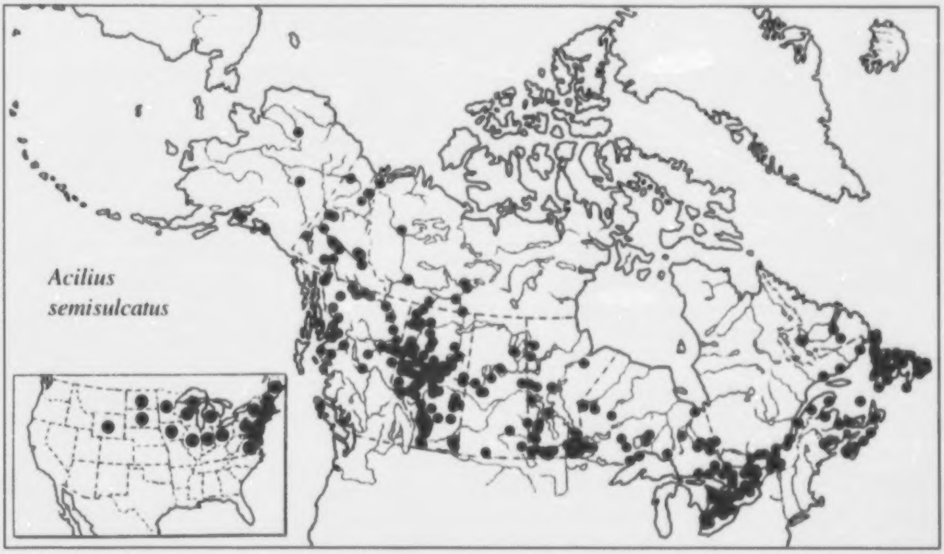
Head testaceous to pale rufous except posterior margin and a M-shaped maculation on frons, brown to piceous. Pronotum yellow with two transverse dark vittae, anterior vitta longer than posterior, with lateral arms reflexed posteriorly and extending back to about level of posterior vitta; punctures on pale portions of pronotal disc not or at most faintly infuscate. Elytron testaceous, irrorate with darker spots; irrorations larger and denser medially and apically on disc and fused as more or less continuous dark areas especially adjacent to subapical pale transverse fascia; fascia narrow, its anterior margin more or less evenly arcuate; female with setae of elytral sulci piceous. Ventral surface mainly black; abdominal sterna with basal and medial areas at least black. Legs mainly yellow except metatibia and metatarsi rufous to brown on many specimens.

Elytron with punctures distinctly crescent-shaped, at least basally.

Male protarsomere 1 (Fig. 187B) in dorsal aspect with posteroapical angle broadly rounded; anterior protarsal claw (Fig. 187F) longer and broader than posterior but of similar shape; mesotarsomeres 1 to 3 each with a tuft of setae on posteroapical angle of ventral surface; aedeagus (Fig. 187K, L) in lateral aspect with apex slightly broadened, rounded apically; paramere with spines on inner dorsal surface small and sparse.

Female elytron sulcate, sulci starting well behind base and basal nonsulcate area about 0.5 to 1x medial length of pronotum; sutural sulcus much shorter than sulcus 2, sulcus 1: length of elytron (from apex of scutellum) = 0.67 to 0.80 (0.90 in western Alaska); sulcus 2: length of elytron = 0.76 to 0.93 (0.96 to 1.00 in western Alaska).

Ecology. The species occurs in a wide range of lentic habitats in forested regions. In western and northern boreal portions of North America specimens are generally in permanent ponds and are common in beaver ponds, borrow pits, roadside ditches and small, fishless lakes. In the northern deciduous forests of eastern North America, the species is more typical of vernal ponds and adults appear to show seasonal migration into such ponds in the spring for breeding. Several descriptions of the larva have been published but Wolfe (1980) pointed out that some of these are probably in error. Wilson (1923) described the larva of *Graphoderus* whereas James (1970) may have had larvae of either *A. semisulcatus* or *A. sylvanus* which were not recognized as separate species at the time. Watt's (1970) description probably applies to this species. Hilsenhoff (1993*a)* gives characters for its separation from other eastern species.



Map 264. *Acilius semisulcatus* Aubé. Canadian and Alaskan collection localities and United States state records.

Distribution. Map 264. *Acilius semisulcatus* has the widest range of any North American species of the genus and its range overlaps with or abuts on the range of all other North American *Acilius* species. The species is basically boreal, occurring from Newfoundland to Alaska, south to central British Columbia, the northern edges of the prairies and northeastern United States.

3. *Acilius abbreviatus* Mannerheim 1843

Acilius abbreviatus Mannerheim 1843: 219. Type locality - Sitka?, Alaska.

Selected References. Hilsenhoff 1975: 273; Larson 1975: 410.

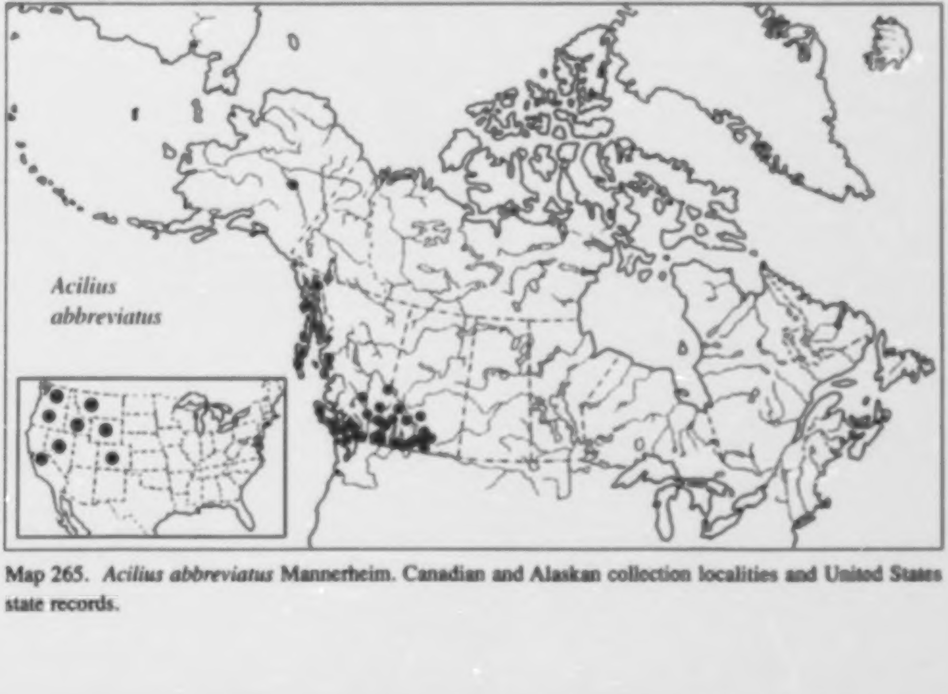
Description. Length = 12.5 to 15.5 mm; width = 7.3 to 9.0 mm; length: width = 1.61 to 1.83.

Very similar to *A. semisulcatus* and may be just a western form. Differences are as follows. Elytra with subapical pale fascia broadened each side of suture and projecting forwards so that anterior margin of fascia does not form an even arc across both elytra; ventral surface of body entirely pale on some specimens, percentage of pale specimens varies geographically. Male anterior protarsal claw not as broad as that of *A. semisulcatus* but still slightly broader and longer than posterior claw; aedeagus similar, parameres with setae on dorsoapical area a little stouter. Female elytron with sulci longer, sulcus 1: length elytron= 0.76 to 0.95; sulcus 2: length elytron = 0.91 to 1.00.

Comments. The name *A. oregonensis* Crotch 1873 probably refers to this species.

Ecology. The majority of specimens we have collected have come from beaver ponds.

Distribution. Map 265. Coastal southern Alaska to California, inland from coast in southern British Columbia and southwestern Alberta and south along Rocky Mountains. The species is generally allopatric with *A. semisulcatus* but may hybridize where ranges are contiguous, e.g.. southwestern Alberta, central British Columbia and southern Alaska.



Map 265. *Acilius abbreviatus* Mannerheim. Canadian and Alaskan collection localities and United States state records.

4. *Acilius sylvanus* Hilsenhoff 1975

Fig. 187C, G, M.

Acilius sylvanus Hilsenhoff 1975: 271 – 3. Type locality - Adams Co., Wisconsin.

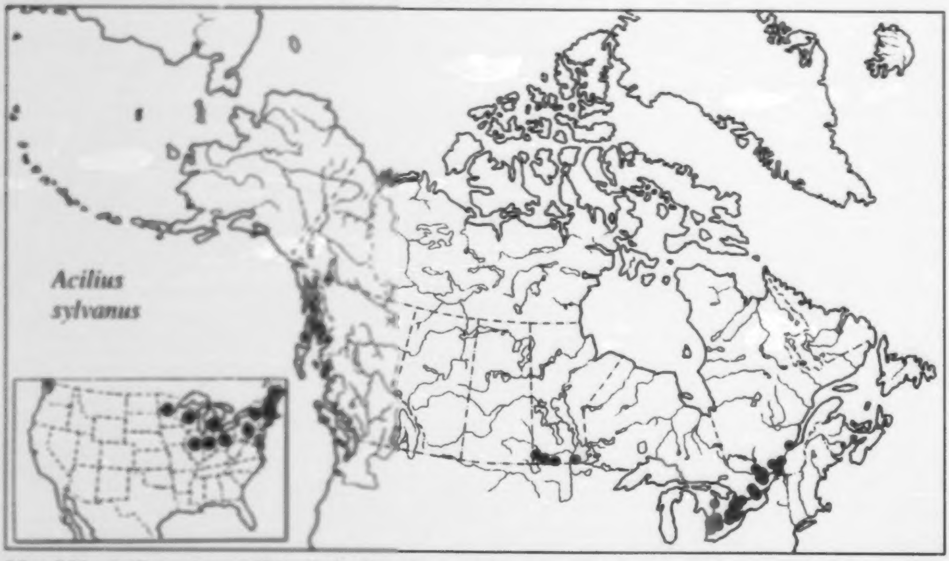
Selected Reference. Hilsenhoff 1993*a*: 39.

Description. Length = 12.3 to 17.0 mm; width = 7.0 to 8.7 mm; length: width = 1.70 to 1.77.

Head mainly reddish-yellow with posterior margin black; medially with variously developed markings, some specimens with a distinct M-shaped mark but most with a diffuse reddish to piceous cloud. Pronotum with medial fascia distinct, some specimens with posterior fascia not connected to lateral arm of anterior; punctures on pale areas of disc not infuscate. Elytron more or less uniformly irrorate with only a slight tendency for fusion of spots just before a broad, ill-defined fasciate area on apical third, many females with no trace of subapical fascia. Ventral surface mainly reddish-yellow, slightly darker reddish medially on metathorax and abdominal sterna, thoracic sutures narrowly black. Legs yellow to reddish brown.

Elytron with dense, large punctures, punctures generally crescentic with anterior margin truncated.

Male protarsomere 1 triangular, posteroapical angle broadly rounded (Fig. 187C) protarsal claws (Fig. 187G) subequal in length and similar in shape, anterior claw only slightly broader than posterior;; mesotarsomeres 1 to 3 each with a large apicoventral tuft of setae. Aedeagus (Fig. 187M) in lateral aspect with apex widened and broadly rounded apically. Female elytron sulcate, sulci starting well posterad of base, sulcus 1: length of elytron (from apex of scutellum) = 0.70 to 0.77; sulcus 2: length of elytron = 0.84 to 0.89, sulci with depressed, brown setae.



Map 266. *Acilius sylvanus* Hilsenhoff. Canadian and Alaskan collection localities and United States state records.

Ecology. These beetles occur in the emergent zone of sun-warmed permanent or semi-permanent ponds in forested areas. Specimens have also been found in boggy lakes near Gatineau Park, Quebec.

Distribution. Map 266. The range includes southern Ontario and Quebec and the northeastern United States from Maine to Minnesota and south to New Jersey.

5. *Acilius fraternus* (Harris 1828)

Fig. 187D, H, N.

Dytiscus fraternus Harris 1828: 156. (a nonsulcate female in the Harris collection should be designated lectotype).

Acilius fraternus dismalus Matta and Michael 1976: 12 – 14.

Selected References. Hilsenhoff 1975: 273; Michael and Matta 1977: 45 – 46; Hilsenhoff 1993*a*: 38.

Description. Length = 13.0 to 15.0 mm; width = 7.7 to 8.4 mm; length: width = 1.70 to 1.80.

Similar to *A. semisulcatus* and often confused with it. Differences are as follows.

Color darker. Head with markings diffuse, reddish, darkened broadly along posterior margin and more diffusely between eyes; elytron of most specimens with irrorations expanded both before and behind subapical pale fascia to produce areas of solid black outlining and accentuating limits of fascia; ventral surface of body largely black, metafemur piceous to black, metatibia and tarsi dark reddish to piceous.

Elytron with punctures more or less round or at most with anterior margin slightly flattened.

Male protarsomere 1 with hind margin relatively narrowly rounded in dorsal aspect (Fig. 187D), protarsal claws (Fig. 187HB) similar in shape;; mesotarsomeres 1 to 3 with small but apparent tufts of setae on apicoventral angle; aedeagus (Fig. 187N) in lateral aspect with apex more parallel-sided and angularly projecting apically. Female elytron lacking sulci.

Comments. Harris (1828) described the female as sulcate and various authors have considered females to be dimorphic in the development of elytral sulci (Hilsenhoff 1975, 1993). However, all female specimens we have examined lacked sulci whereas specimens with sulci are other species (generally *A. semisulcatus*). *A. fraternus dismalus*, based on this misinterpretation, applies to true *A. fraternus*.

Ecology. Matta and Michael (1976) describe the habitat as shaded woodland pools. Wolfe (1980) found larvae in a temporary woodland pool which had a primarily sphagnum substrate.

Distribution. The range extends from New York to Florida and Texas and the species is generally allopatric with *A. semisulcatus* except in the northeastern part of its range. Although the species has been recorded from Canada (Hilsenhoff 1975; Matta and Michael 1976), we have not seen Canadian specimens and suspect such records are based on misidentification.

6. *Acilius athabascae* Larson 1975

Fig. 186B, 187O.

Acilius athabascae Larson 1975: 410 – 412. Type locality - Prince Albert, National Park, Saskatchewan.

Selected Reference. Larson 1975: 410 – 412.

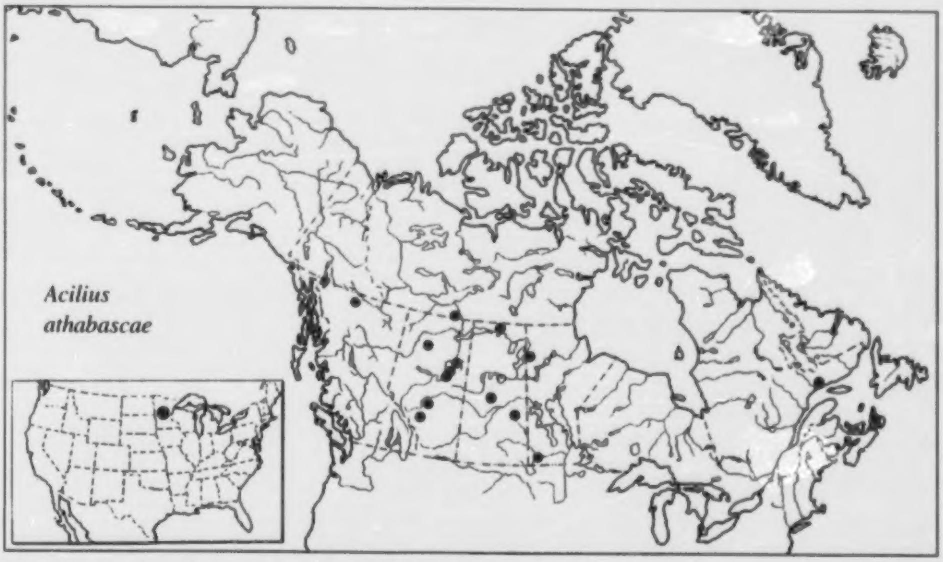
Description. Length = 13.5 to 15.5 mm; width = 8.3 to 8.5 mm; length: width = 1.66 to 1.71.

Color pattern as in Fig. 186B. Ground color pale yellow. Head with piceous markings along posterior margin and on frons between eyes sharply defined. Pronotum with many infuscate punctures on disc laterad and posterad to transverse fasciae making disc somewhat irrorate. Elytron with subapical pale fascia absent or indistinct, with a diffuse area of slightly larger irrorations forming an obscure transverse dark band. Ventral surface and legs pale yellow.

Elytron with punctures irregular, rounded to crescentic in shape.

Male protarsomere 1 as in *A. semisulcatus*; protarsal claws (Fig. 187I) elongate, anterior claw much longer than posterior; mesotarsomeres 1 to 3 with very strong brushes of setae on posterior margins; aedeagus (Fig. 187O) with apex produced as a rounded crest. Female elytron with sulci extending almost to base, sulcus 1: length of elytron (from apex of scutellum) = 0.95 to 0.99; sulcus 2: length of elytron = 0.97 to 0.99; sulci bearing long, suberect, yellow setae.

Ecology. This species is poorly collected but several series have been taken from small, boggy boreal ponds and lakes which have extensive moss mats along their margins. The beetles occur in deep water along the edge of the moss mat and in beaver runs through the mat. Teneral specimens were collected May 28, Rocky Mountain House, Alberta (CARR).



Map 267. ***Acilius athabascae*** **Larson. Canadian and Alaskan collection localities and United States state records.**

Distribution. Map 267. Collection records extend from Nova Scotia to northern British Columbia. Larson (1975) was unable to locate Grand Etang, Pembroke L. (locality of one of the paratypes, CNC) but we have located it in Cape Breton Island, Nova Scotia. The species is probably widely distributed in the boreal zone.

Genus *Graphoderus* Dejean 1833
Figs. 188; 189; 190.

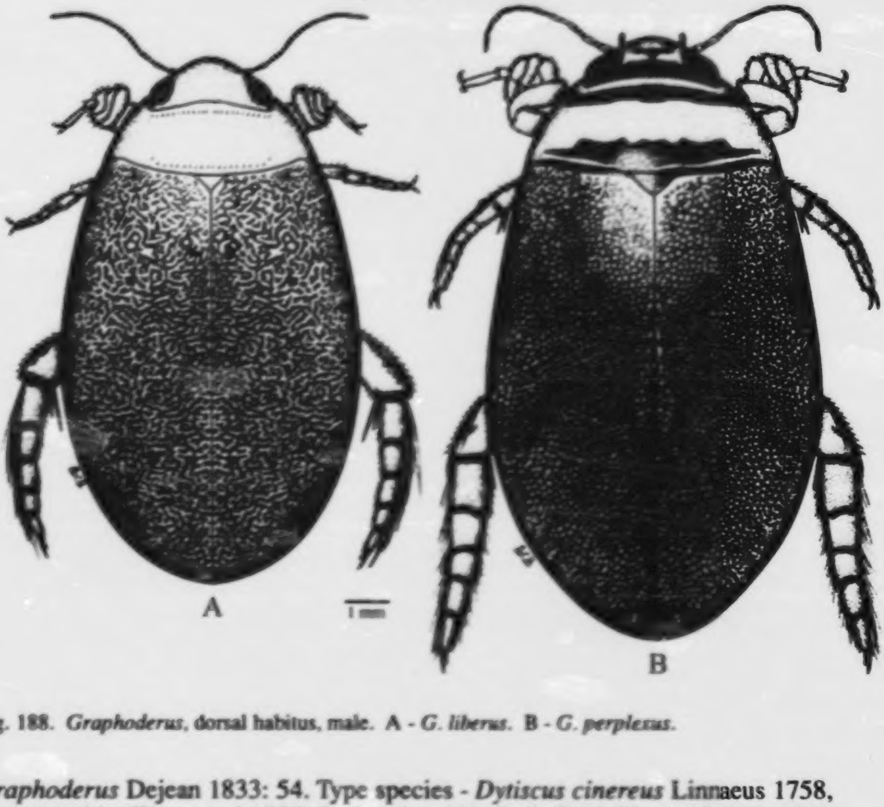


Fig. 188. *Graphoderus*, dorsal habitus, male. A - *G. liberus*. B - *G. perplexus*.

Graphoderus Dejean 1833: 54. Type species - *Dytiscus cinereus* Linnaeus 1758, designated by Westwood 1838: 8 (Opinion 618, Bull. Zool. Nom. 18: 365, 1961).

Diagnosis. Dytiscinae of moderate size, Length = 10.4 to 15.0 mm. Body broadly ovate, depressed (Fig. 188).

Body with ground color yellow, head and pronotum (Figs. 188; 189A–C) with or without black maculations, elytra with dark maculations, these taking the form of vermiculate markings laterally, medially markings variously fused forming a black mesh-work with rounded to elongate pale spots; ventral surface yellow to pale reddish; antenna and palpi mainly yellow, infuscate apically.

Elytra with punctation fine, dual, composed of small punctures and more numerous very fine punctures; some females with larger punctures denser, deeper and elongated basolaterally and sublaterally on disc.

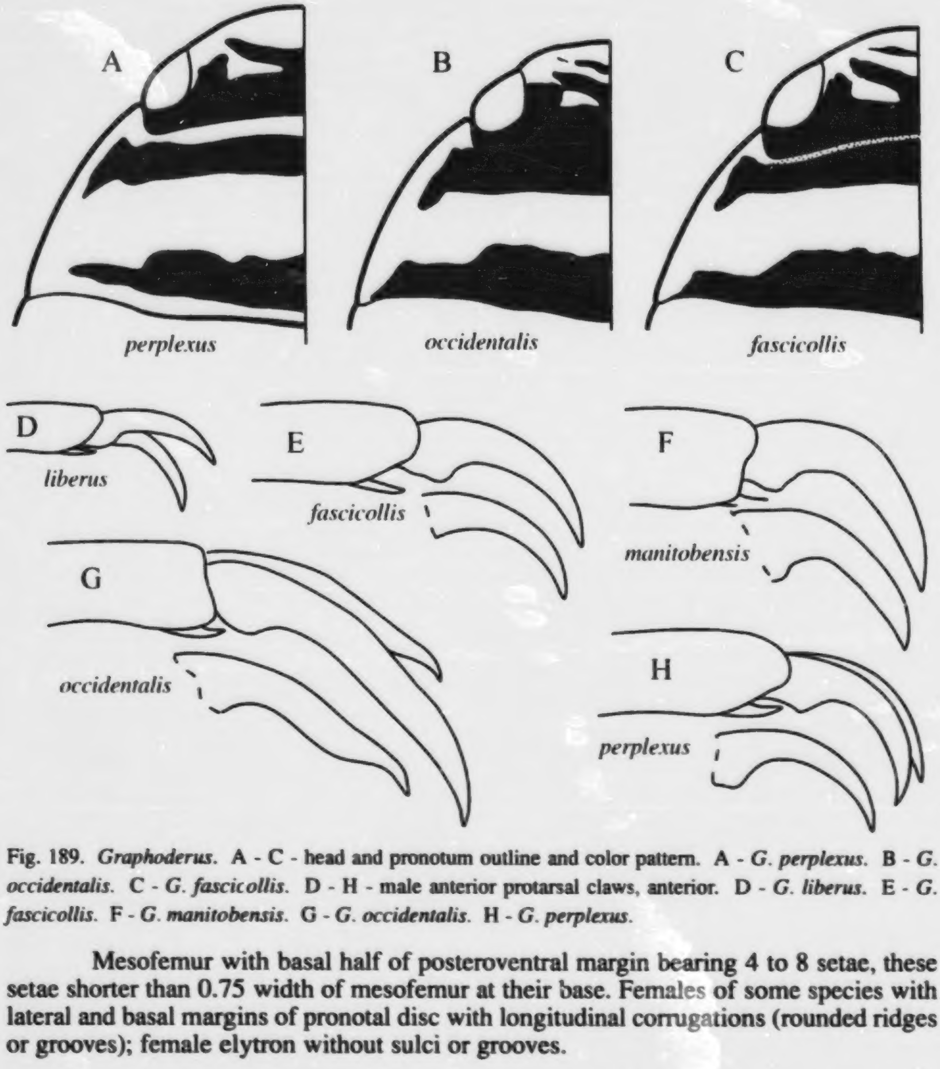


Fig. 189. *Graphoderus*. A - C - head and pronotum outline and color pattern. A - *G. perplexus*. B - *G. occidentalis*. C - *G. fascicollis*. D - H - male anterior protarsal claws, anterior. D - *G. liberus*. E - *G. fascicollis*. F - *G. manitobensis*. G - *G. occidentalis*. H - *G. perplexus*.

Mesofemur with basal half of posteroventral margin bearing 4 to 8 setae, these setae shorter than 0.75 width of mesofemur at their base. Females of some species with lateral and basal margins of pronotal disc with longitudinal corrugations (rounded ridges or grooves); female elytron without sulci or grooves.

Male protarsal palette ventrally with two or three larger round discs at base and 13 to 38 smaller more distal discs; mesotarsomeres 1 to 3 with or without adhesive discs, without distinct setal tufts. Aedeagus (Fig. 190A - D) subequal in length to parameres or shorter, its apex in ventral aspect rounded to trilobed. Female gonocoxa sclerotized, laterally compressed and elongate but bluntly pointed apically.

Comments. The North American species have been reviewed by Wallis (1939) and Tracy and Hilsenhoff (1982). Larvae of unspecified species have been described by Wilson (1923) and Watts (1970) and a key to larvae of Wisconsin species provided by Hilsenhoff (1993*a*). With the exception of *G. liberus*, the North American species are very similar amongst themselves. *Graphoderus liberus* is distinctively colored in both larval and adult stages and possesses a number of distinctive structural characters. A good case could be made for placing it in its own subgenus, but this action should be delayed until its isolated position is demonstrated through a cladistic analysis of the world fauna.

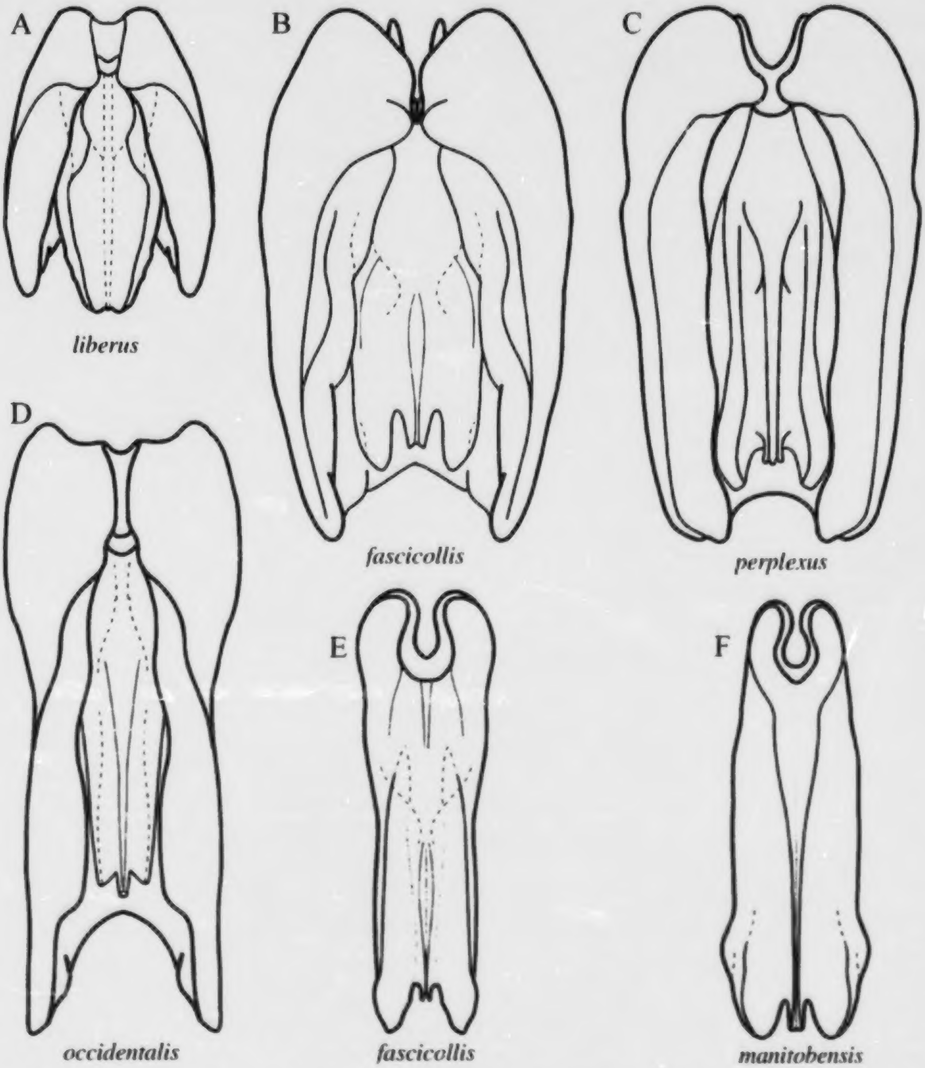


Fig. 190. *Graphoderus*, male genitalia. A – D - aedeagus and parameres, ventral. A - *G. liberus*. B - *G. fascicollis*. C - *G. perplexus*. D - *G. occidentalis*. E – F - *aedeagus* ventral. E - *G. fascicollis*. F - *G. manitobensis*.

The species are univoltine with adults overwintering. Hilsenhoff (1993*a)* has observed temporal variation between species in the time of breeding and larval development. All species are lentic and occur in open, sun-warmed ponds although *G. liberus* and *G. perplexus* are often in peatland ponds and bog-ringed lakes (Larson and House 1990). Both adults and larvae are active and can often be observed swimming in open water near shore or along beds of aquatic plants. We have observed adults of *G. occidentalis* in prairie ponds and *G. perplexus* in small boreal lakes feeding on insects trapped in the surface film of the water, in this respect resembling the feeding of co-occurring species of *Notonecta* (Hemiptera).

Key to species of *Graphoderus* of North America
(modified from Wallis 1939*a*)

1. Head and pronotum entirely yellow to reddish brown, without black markings (Fig. 188A); smaller, length = 10.4 to 12.4 mm ....1. *G. liberus* (Say)

1'. Head and pronotum pale with well defined black markings (Figs. 188B; 189A - C); larger, length = 11.1 to 15.0 mm 2

2(1). Pronotum (Fig. 189A) with posterior fascia not reaching hind margin but on some specimens separated only by a faint reddish line; anterior pronotal fascia separated from front margin; male protarsus with 3 large and 25 to 35 smaller discs, mesotarsus with 13 to 17 discs ....2. *G. perplexus* Sharp

2'. Pronotum (Fig. 189B, C) with posterior black fascia contiguous with hind margin; anterior pronotal fascia contiguous with anterior margin or not; male with number of discs on ventral surfaces of pro- and mesotarsi various 3

3(2). Male mesotarsus not dilated, without ventral discs; female pronotum with corrugated sculpture obsolete; pronotum (Fig. 189B) with anterior black fasciae contiguous with anterior margin . . . 3. *G. occidentalis* Horn

3'. Male mesotarsus dilated and with discs on ventral surface; female pronotum with conspicuous corrugated sculpture; pronotum (Fig. 189C) of most specimens with anterior black fascia separated from anterior margin by a more or less evident reddish area 4

4(3). Metasternal wing broad, width = 0.48 to 0.60 mm; male mesotarsus ventrally with 12 adhesive discs arranged in two rows .... 4 . *G. fascicollis* (Harris)

4'. Metasternal wing narrower, width = 0.30 to 0.41 mm; male mesotarsus with 25 to 30 adhesive discs in four rows ..... 5. *G. manitobensis* Wallis

1. *Graphoderus liberus* (Say 1825)
Figs. 188A; 189D; 190A.

Dytiscus liberus Say 1825: 160. Type locality - Massachusetts.

Selected References. Larson 1975: 407; Michael and Matta 1977: 48; Hilsenhoff 1993*a*: 47.

Description. Smallest species of the genus. Length = 10.4 to 12.4 mm; width = 6.4 to 7.0 mm; length: width = 1.63 to 1.76.

Color as in Fig. 188A. Head testaceous anteriorly, basal half rufous. Pronotum testaceous laterally, disc rufous to brownish medially. Elytron testaceous with vermiculate dark markings, medially vermiculations more extensively fused producing an irregular mesh-work with pale vermiculations. Ventral surface and legs testaceous to rufous.

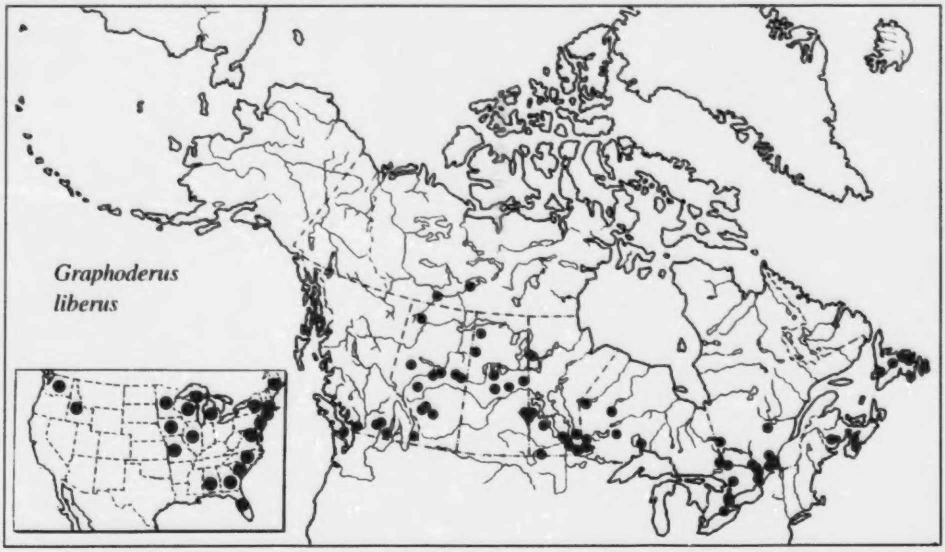
Elytron finely and densely punctate; punctation dual but many specimens with coarser punctures sparse and only slightly larger than the much more numerous minute punctures; some females with larger punctures slightly enlarged and denser basolaterally; interspaces with variously effaced reticulation.

Pronotum with posterolateral angle produced, acute but narrowly rounded apically. Female pronotum with at most a few narrow longitudinal lines or faint longitudinal corrugations. Metasternal wing narrow, WS = 0.26 to 0.37 mm.

Male protarsal palette with three large basal and 17 or 18 smaller adhesive discs; mesotarsomeres 1 to 3 together with 6 adhesive discs on ventral surface; protarsal claws (Fig. 189D) subequal in length, similar in shape. Aedeagus (Fig. 190A) short and broad, apex very shallowly bisinuate but not strongly trilobed; paramere subequal in length to aedeagus, apex broadly rounded or obliquely truncate in lateral aspect.

Ecology. These beetles occur in boggy (often brown-water) ponds and lakes. They are usually found at the edge of the encircling quaking bog in embayments or beaver runs. Although the species has an extensive range, specimens tend to be of very localized occurrence. For example they may be common year after year in one pond but apparently absent from many other similar ponds within the region.

Distribution. Map 268. The species occurs only in forested areas. The range is transcontinental, from Newfoundland to British Columbia and south in the east to Florida.



Map 268. *Graphoderus liberus* (Say). Canadian and Alaskan collection localities and United States state records.

2. *Graphoderus perplexus* Sharp 1882

Figs. 188B;189A, H; 190C.

Graphoderus perplexus Sharp 1882*a*: 695. Type locality – "Am. bor.", United States.

Selected References. Larson 1975: 407 – 408; Tracy and Hilsenhoff 1982: 164; Hilsenhoff 1993*a*: 48 – 49; Larson 1997*b*: 514.

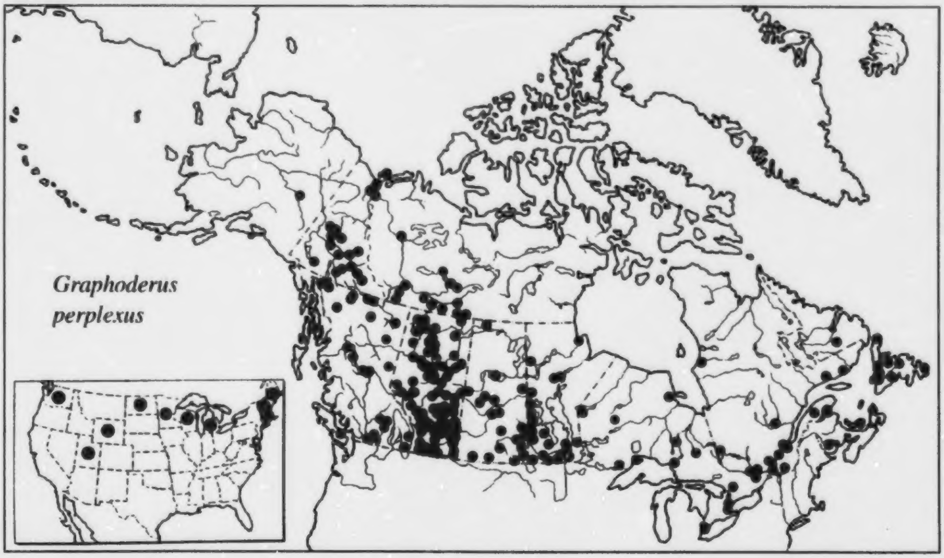
Description. The largest Nearctic species of the genus. Length = 14.0 to 15.0 mm; width = 8.2 to 8.8 mm; length: width = 1.66 to 1.78.

Color pattern as in Figs. 188B; 189A. Head yellow with black markings, frontal spots of most specimens contiguous with pale anterior area, black area mesad to eye narrowly separated from eye by yellow. Pronotum testaceous except both anterior and posterior margins with a submarginal piceous fascia, anterior fascia broadly separated from anterior margin by testaceous band, posterior fascia narrowly separated from hind margin by testaceous or rufous band. Elytron testaceous with black vermiculate spots laterally, medially marks coalescent to form black mesh-work enclosing rounded pale spots. Epipleuron, ventral surface and most of legs testaceous to pale rufous, some specimens with metatibia and metatarsi darker, rufous to piceous.

Elytron with punctation fine, dual with small evenly scattered punctures and much more numerous minute punctures; interspaces with somewhat effaced microreticulation.

Pronotum with posterolateral angle relatively shortly produced and apically rounded. Female pronotum with distinct corrugated macrosculpture on posterolateral portions of disc. Metasternal wing relatively narrow, width = 0.35 to 0.45 mm.

Male protarsal palette with three large and 25 - 35 small round adhesive discs on ventral surface; mesotarsomeres 1 to 3 dilated and together bearing 13 to 17 adhesive discs. Protarsal claws (Fig. 189H) short, arcuate, similar in shape but anterior claw slightly longer than posterior. Aedeagus (Fig. 190C) narrow, relatively long, with apex strongly trilobed in ventral aspect; paramere slightly longer than aedeagus, with apex bluntly pointed and bearing dense, short setae on mesal margin.



Map 269. ***Graphoderus perplexus*** **Sharp. Canadian and Alaskan collection localities and United States state records.**

Ecology. This species occurs in open, sun-warmed permanent ponds and small lakes in both forested and grassland regions. It is common in large bog pools and bog-ringed lakes of the boreal region.

Distribution. Map 269. Larson (1975) stated the range was restricted to northwestern North America. However, the species has been found to be abundant in the boreal zone of eastern Canada so that the species is transcontinental, primarily in the boreal zone.

3. *Graphoderus occidentalis* Horn 1883

Figs. 189B,G; 190D.

Graphoderus occidentalis Horn 1883: 281. Type locality - California and Washington Territory.

Selected References. Larson 1975: 408; Tracy and Hilsenhoff 1982: 164; Hilsenhoff 1993*a*: 48; Larson 1997*b*: 514.

Description. A moderate sized, relatively narrow species. Length = 11.1 to 14.4 mm (specimens from B.C. are larger than those from prairies, averaging about 1 mm longer (mean length = 13.7 vrs. 12.7 mm)); width = 6.4 to 7.8 mm; length: width = 1.73 to 1.84.

Head (Fig. 189B) with black markings relatively expanded, most specimens with pale frontal spots entirely enclosed by black and isolated from pale anterior area; black lateral area contiguous with inner margin of eye. Pronotum (Fig. 189B) with transverse fasciae broad, anterior and posterior fasciae contiguous with frons and hind margins of pronotum respectively. Elytron laterally with dark vermiculate markings, medially dark area forming a meshwork enclosing rounded pale spots. Ventral surface yellow to pale rufous, hind legs darkened on most specimens.

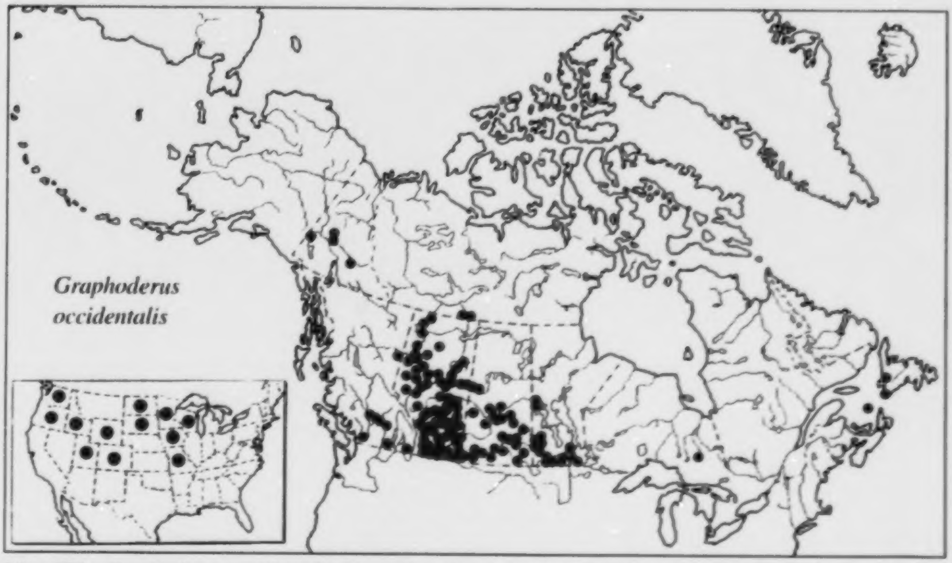
Elytron with punctation coarser than in *G. perplexus*, disparity in size between larger and more numerous smaller punctures less distinct; interspaces with fine reticulate sculpture.

Pronotum with posterolateral angle prolonged posteriorly, acute but narrowly rounded apically. Female pronotum with corrugated macrosculpture obsolete. Metasternal wing broad, width = 0.45 to 0.55 mm.

Male protarsus with palette bearing 15 large round discs on ventral surface; mesotarsomeres 1 to 3 not dilated, without adhesive discs; protarsal claws (Fig. 189G) dissimilar in size and shape, anterior claw very long and relatively straight, posterior claw about two thirds length of anterior, narrower, sinuate ventrally and arcuate in dorsal aspect. Aedeagus (Fig. 190D) with apex shortly trilobed in ventral aspect; median lobe narrow, short; paramere longer than aedeagus, evenly narrowed and sharply pointed apically, mesal margin inconspicuously setose.

Ecology. These beetles occur in the emergent zone of both temporary and permanent ponds. They are most common in grassland ponds or ponds in open, sun-exposed sites.

Distribution. Map 270. The species is transcontinental but it is only common in grassland areas of the west. The range extends from Newfoundland to British Columbia and from Utah and California north to the western Northwest Territories and Yukon Territory.



Map 270. *Graphoderus occidentalis* Horn. Canadian and Alaskan collection localities and United States state records.

4. *Graphoderus fascicollis* (Harris 1828)

Figs. 189E; 190B, E.

Dytiscus fascicollis Harris 1828*a*: 156. Type locality - not given.

Selected References. Wallis 1939*a*: 128 – 130. Tracy and Hilsenhoff 1982: 164; Hilsenhoff 1993: 45, 47.

Description. Moderate sized, broad species. Length = 13.0 to 14.4 mm; width = 7.5 to 8.2 mm; length: width = 1.64 to 1.75.

Head and pronotum pattern as in Fig. 189C; most specimens with pale frontal spots contiguous with pale frontal area, black area mesad to each eye narrowly separated from eye by a pale area. Pronotum with anterior transverse fascia narrowly separated from anterior margin by a yellow to rufous area; posterior transverse fascia contiguous with hind margin.

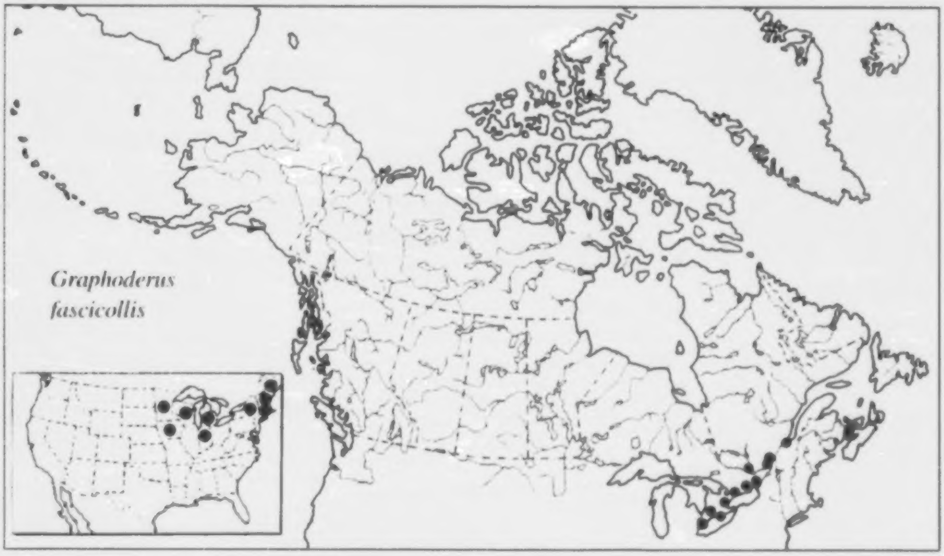
Elytron with larger punctures fine medially, deeper laterally, especially on some females where punctures are deep and somewhat linearly extended on shoulder and sublaterally on basal half of elytron.

Pronotum with posterolateral angle slightly produced, acute but narrowly rounded apically. Female pronotum with distinct longitudinal corrugations basolaterally. Metasternal wing broad, width = 0.48 to 0.60 mm.

Male protarsal palette with 3 large basal and 22 to 23 smaller adhesive discs; mesotarsus with 12 adhesive discs; anterior protarsal claw (Fig. 189E) slightly longer and broader than posterior, both evenly arcuate and narrowed to apex. Aedeagus (Fig. 190B, E) in ventral aspect with apex strongly trilobed; paramere slightly longer than aedeagus.

Ecology. Specimens have been collected from the emergent zone of permanent ponds, usually in or near deciduous forest. The species is common in beaver ponds in the Gatineau region of Quebec.

Distribution. Map 271. In Canada, all records are from western Nova Scotia (Amherst, Colchester Co., 1 , Nova Scotia Department of Natural Resources Collection, Halifax) and southern Ontario and Quebec. In the United States, the species occurs in the northeast, west to Minnesota.



Map 271. *Graphoderus fascicollis* (Harris). Canadian and Alaskan collection localities and United States state records.

5. *Graphoderus manitobensis* Wallis

Figs. 189F; 190F.

Graphoderus manitobensis Wallis 1933*b*: 276 – 278. Type locality - Winnipeg, Manitoba.

Selected References. Tracy and Hilsenhoff 1982: 163 – 164; Hilsenhoff 1993*a*: 47 – 48.

Description. Similar to *G. fascicollis*, most easily recognized on male tarsal characters and the narrow metasternal wing. Length = 13.2 to 14.8 mm; width = 7.6 mm; length: width = 1.78.

Color similar to *G. fascicollis*. Pronotum with anterior transverse fascia continuous with anterior margin; posterior fascia reaching hind margin. Elytron laterally with black vermiculate markings, on disc these markings contiguous and forming a mesh-work around pale spots. Ventral surface and legs rufous to rufopiceous, metatibia and metatarsi darkened.

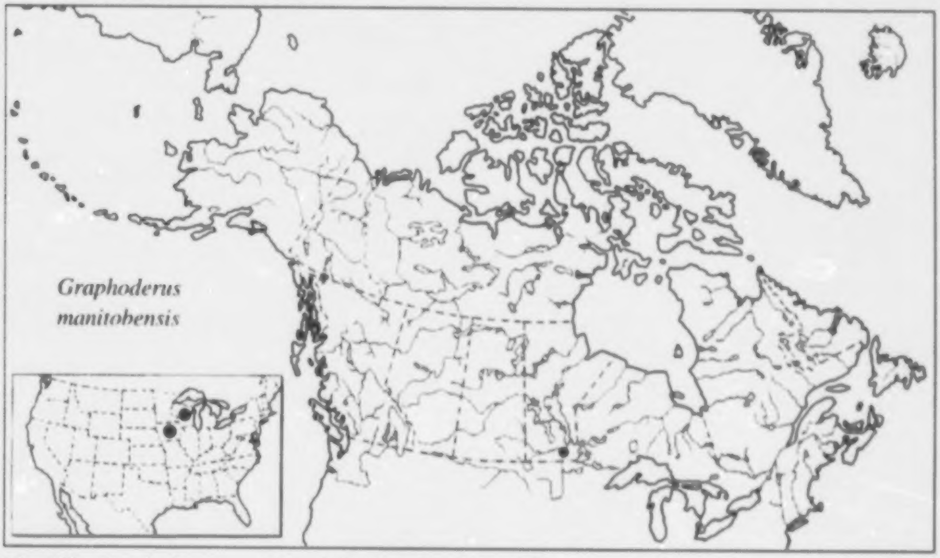
Elytron with dual punctation, larger punctures small but distinct at 20x magnification and much more numerous fine punctures; interspaces with variously effaced reticulation. Female elytron near shoulder near lateral margin with deeply impressed punctures or short strioles.

Pronotum with hind angle slightly produced and acute, narrowly rounded apically. Female pronotal disc with pronounced longitudinal corrugations on lateral portions of disc. Metasternal wing narrow, width = 0.30 to 0.40 mm.

Male protarsal palette with three large and about 28 to 38 smaller adhesive discs; mesotarsomeres 1 to 3 together with 26 to 29 adhesive discs; protarsal claws (Fig. 189F) subequal in length, similar in shape, rather strongly bent medially. Aedeagus as in Fig.190F.

Ecology. Hilsenhoff (1993*a)* described the habitat as being large sedge and cattail marshes and ponds in open areas..

Distribution. Map 272. This species is known only from the type locality and several localities in southern Wisconsin.



Map 272. *Graphoderus manitobensis* Wallis. Canadian and Alaskan collection localities and United States state records.

Genus *Thermonectus* Dejean 1837
Fig. 191.

Thermonectus Dejean 1837: 61. Type species - *Dytiscus circumscriptus* Latreille. (see Nilsson *et al.* 1989 for a discussion of the correct spelling on this name).

Diagnosis. Dytiscinae of small to moderate size, Length = 7.5 to 13.5 mm. Body (Fig. 191A) ovate, slightly to moderately convex.

Color various, dorsal surface largely black with pale dorsal markings to primarily yellow with dark maculations; ventral surface yellow to piceous. Antenna and palpi of most specimens entirely yellow but some with light apical infuscation.

Elytra with punctation fine, dual, composed of small punctures and more numerous very fine punctures; most females with deep elongate punctures or grooves on

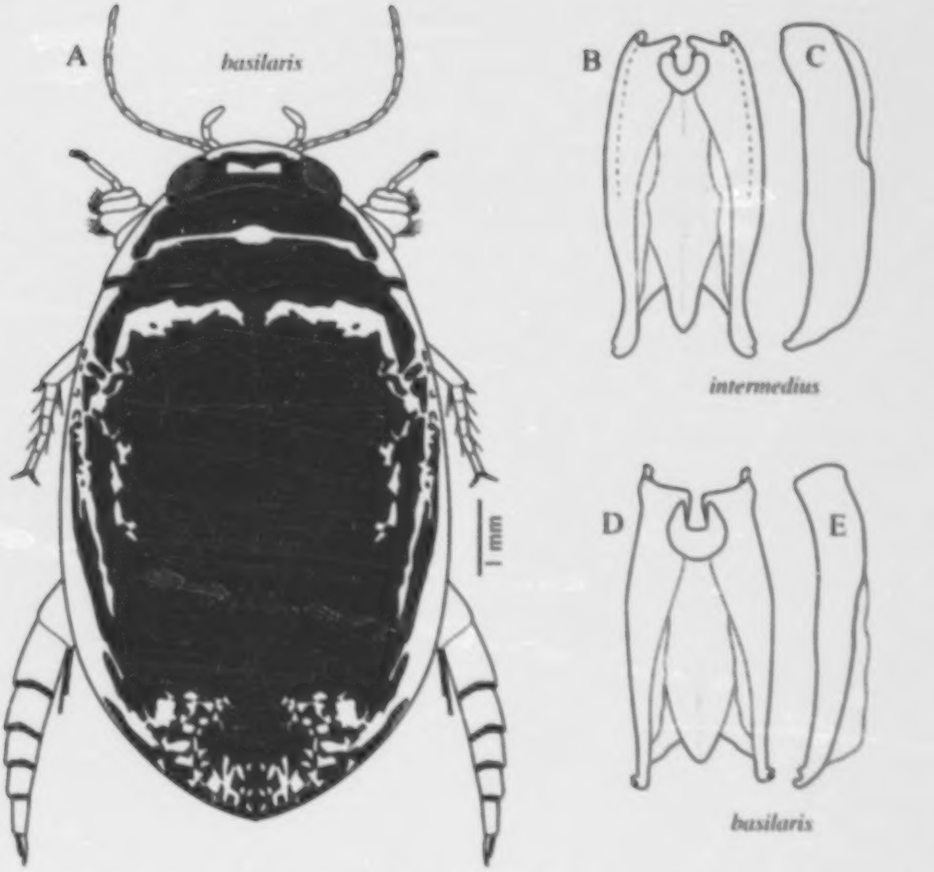


Fig. 191. *Thermonectus*. A - *T. Basilaris* male. B,C - *T. intermedius*. B - eadeagus and parameres, ventral. C - paramere, lateral. D – E - *T. basilaris*. D - aedeagus and parameres, ventral. E - paramere lateral.

basomedial and lateral portions of disc, some females with similar coarse grooves on pronotum; female elytron without sulci.

Mesofemur with posteroventral margin bearing 3 to 8 long setae, greater in length than width of mesofemur at their base. Mesotarsomeres 1 to 3 (and protarsomeres 1 to 3 of female) each bearing a pair of long apicoventral setae, setae slightly shorter to longer than following tarsomere.

Male protarsal palette ventrally with three large adhesive discs and a variable number of smaller discs; mesotarsomeres 1 to 3 without adhesive scales or distinct setal tufts. Female gonocoxae very elongate and slender, lightly sclerotized.

Comments. The genus name has been spelt in a variety of ways. We follow Nilsson *et al.* (1989) who recommend the use of *Thermonectus* Dejean 1837 in order to promote stability.

This exclusively New World genus is primarily warm temperate to tropical and has a distribution that is largely complimentary to that of the more northern *Acilius* and *Graphoderus*. One species occurs as far north as southernmost Canada.

Most species are lentic, inhabiting temporary to permanent ponds. However, the strikingly colored species, *T. marmoratus* Hope and *T. zimmermani* Goodhue-McWilliams, occur in pools of intermittent desert streams (Larson 1996*a*). Many of the lentic species fly readily and are often collected at light. Hilsenhoff (1993*a)* discussed the habitat and life history of the two species occurring in Wisconsin. He concluded that both are univoltine, with adults overwintering in terrestrial habitats which they do not leave until late spring or early summer. Larval development is then rapid for they are able to take advantage of dry pools that suddenly become filled by rain over the summer. Hilsenhoff assumed the overwintering pattern because adults did not appear in his collections until relatively late in the season. However, another interpretation is that these species may not overwinter in northern parts of the range and that their appearance in the north is due to dispersal of adults from the south. These highly mobile insects may be opportunistic breeders, colonizing habitat and breeding as water levels and temperatures permit.

Hilsenhoff (1993*a)* gives characters for the separation of the larvae of *T. basillaris* and *T. ornaticollis*.

Key to species of *Thermonectus* of North America

1. Elytron black, without irrorations but with large yellow lateral and discal spots; ventral surface yellow to rufous 2

1'. Elytron yellow with black irrorations, or if disc black, yellow maculations restricted primarily to base, lateral margin and apex and ventral surface dark rufous to piceous 3

2(1). Pronotum mainly black with broad lateral margins and a pair of transverse medial spots, yellow; elytron with large yellow discal spots, the largest being medially near sutural margin; length = 11.4 to 14.0 mm; New Mexico, Arizona, California, Mexico; .... *T. marmoratus* Hope 1832

2'. Pronotum yellow except for a bilobed medial spot contiguous with basal margin, anterior margin narrowly infuscate on some specimens; elytron with yellow maculations transversely confluent forming irregular basal, medial and apical transverse series or bands; length = 9.4 to 11.0 mm; central and western Mexico .... *T. zimmermani* Goodhue-McWilliams 1981

3(1). Pronotum entirely yellow or with a few small dark spots near anterior and posterior margins; elytron yellow with black irrorations and an indistinct subapical transverse fascia; Arizona, Mexico .... *T. sibleyi* Goodhue-McWilliams 1981

3'. Pronotum with strong transverse black fasciae or disc mainly black 4

4(3). Elytron medially black, irrorate laterally and lateral margin yellow, many specimens with a transverse yellow subbasal band; pronotum with anterior and posterior margins broadly black, these black areas contiguous with margins and on some specimens fused medially to make disc largely black; ventral surface of body dark rufous to piceous 6

4'. Elytron irrorate with black, most specimens with a faint to strongly developed postmedian transverse black fascia; pronotum with a subapical and a subbasal transverse black fascia, neither fascia contacting margin but on some specimens lateral backwards extension of anterior fascia contacting posterior fascia; ventral surface yellow to rufous .... *T. nigrofasciatus* Aubé, 5

5(4). Elytron with a distinct postmedial transverse black band; pronotum of males smooth, of females with numerous longitudinal strioles laterally; female elytron with longitudinal strioles extending over basal two-thirds or more; western Texas, New Mexico, Arizona .... *T. n. nigrofasciatus* Aubé 1838

5'. Elytron without a distinct postmedial black band or band diffuse and formed by fusion of some dark irrorations; pronotum smooth in both sexes, except for usual marginal punctures; female elytron with longitudinal strioles on basal half or less; eastern United States, north to Wisconsin and North Dakota, west to Texas, Oklahoma and Kansas .... *T. n. ornaticollis* Aubé 1838

6(4) Pronotum with anterior and posterior black fascia completely separated by yellow space on most specimens (Fig. 191A); elytron of most specimens with a well developed yellow subbasal band; male paramere (Fig. 191E) in lateral aspect evenly narrowed to apex, aedeagus in ventral aspect (Fig. 191D) with lateral margin broadly arcuate and apex bluntly pointed; eastern United States and southern Canada .... 1. *T. basilaris* Harris

6'. Pronotum with anterior and posterior black fasciae partly or completely confluent on most specimens, interspace when present rufous and darker in color than yellow lateral margins; elytron of most specimens lacking yellow subbasal band; male paramere (Fig. 191C) broader in lateral aspect, of more or less even width along length until abruptly narrowed at apex; aedeagus (Fig. 191B) with lateral margin concave and apex narrowly pointed; western United States, New Mexico to California, north to Oregon .... *T. intermedius* Crotch 1873

1. *Thermonectus basilaris* (Harris 1829)

Fig. 191A, D, E.

Dytiscus basillaris Harris 1829: 1. Type locality - not given.

Selected Reference. Hilsenhoff 1993*a*: 52.

Description. Length = 8.1 to 10.7 mm; width = 4.7 to 5.9 mm; length: width = 1.72 to 1.82. Body (Fig. 191A) broadly oval, depressed.

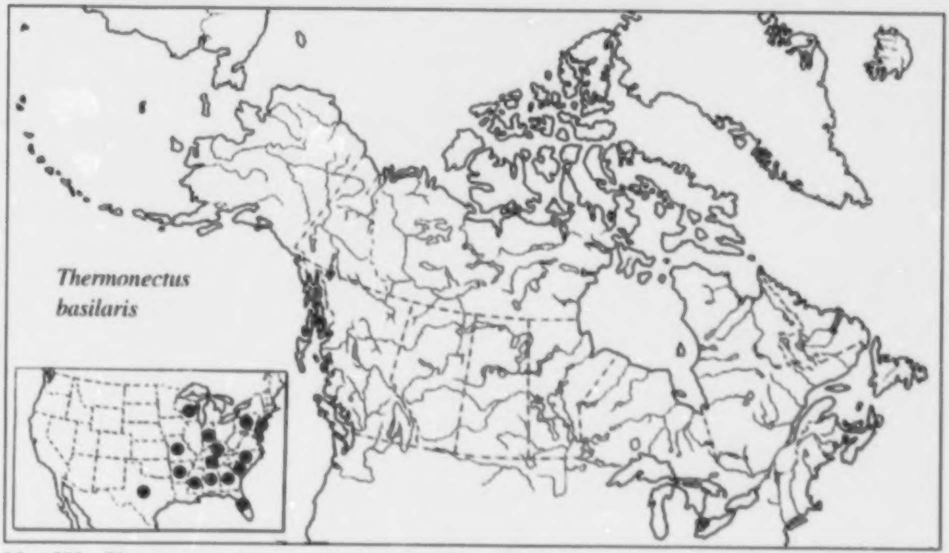
Color pattern as in Fig. 191A. Head black basally with a bilobed yellow frontal bar between eyes; anterior portion yellow with yellow extending posteriorly along mesal margin of eye to about middle and triangularly produced medially on frons. Pronotum with very broad black apical and basal transverse fasciae, fasciae not contacting lateral margin but contiguous with anterior and posterior margins respectively, fasciae narrowly separated by yellow space on most specimens. Elytron with disc black medially except base with a transverse yellow band on most specimens, disc becoming irrorate sublaterally and yellow laterally. Ventral surface largely rufopiceous.

Female with strongly developed strioles on lateral portions of pronotum and basal half of elytron.

Male with paramere (Fig. 191E) evenly narrowed apically in lateral aspect; aedeagus (Fig. 191D) broad, apex bluntly pointed.

Ecology. Young (1954) stated that this is a pioneering species that is likely to appear anywhere that clear, temporary ponds appear. These beetles fly readily and in at least the southern United States frequently come to light in numbers.

Distribution. Map 273. The range extends from southern Ontario to the Gulf of Mexico and west to Texas. Records of *T. basilaris* from the western United States apparently refer to *T. intermedius* Crotch.



Map 273. *Thermonectus basilaris* (Harris). Canadian and Alaskan collection localities and United States state records.

Tribe Eretini Crotch 1873

Diagnosis. Size moderately large, length = 10.2 to 16.8 mm. Body outline discontinuous in dorsal aspect, pronotum narrow with lateral margin almost straight to slightly arcuate, elytron more rounded with point of maximum width near middle; dorsal surface flattened, ventral surface more strongly convex.

Color pale yellow to pale brown. Dorsal surface variously maculate; elytron irrorate with dark spots, each centred on a puncture. Sculpture of elytron consisting of variously effaced, fine microreticulation, micropunctures (subequal in diameter to meshes of microreticulation or smaller) evident or not; with more or less equally spaced larger punctures. Metacoxal plates finely microreticulate, with numerous fine, transverse strioles; abdomen with strioles strong and oblique anterolaterally, finer and transverse medially and apically.

Head with eyes very large and convexly protruding; anterior margin entire. Clypeus with anterior margin broadly emarginate; fovea large and rounded, well removed from anterolateral angle. Frons with frontal foveae between anterior margins of eyes deep. Antenna slender, narrowing apically from antennomere 4. Maxillary palpus with apical palpomere cylindrical, truncate apically. Labial palpus with apical palpomere fusiform, apex truncate to faintly bifid, anteromedial surface with an oval pruinose (sensory) area.

Pronotum trapezoidal, lateral margins straight to slightly convex, converging anteriorly; posterolateral angles acute to more or less right angled; basal margin almost straight medially, variously produced posteriorly towards lateral angle; lateral bead distinct but narrow. Elytron with a row of short, stout spines along apicolateral margin; apex produced as a short, acute spine; elytron flat and poorly fitted to body; epipleuron very narrow, basally fitting into groove of metepisternum at shoulder then narrowing to level of visible sternum 1, apically slightly widened below row of lateral spines. Prosternum very short in front of procoxae; midline in lateral aspect almost vertical anteriorly, then deflected backwards and on continuous plane with midline of prosternal process; prosternal process slender, blade only slightly wider than neck between procoxal cavities, surface slightly to strongly convex in cross-section, apex acuminate. Metasternum with anteromedial lobe with a sharp V-shaped impression for reception of apex of prosternal process; metasternal wings narrow, anterolateral margin arcuate. Front and middle legs slender, femora and tibia (protibia modified on male) broadest near base and narrowed apically, ventrally fringed with two rows of long yellow setae. Mesotarsomeres progressively increasing in length from base to apex, claws slender and much longer than mesotarsomere 5. Metatibia short, about two-thirds length of metafemur; dorsal surface with a subapical transverse row of long apically bifid setae and apical margin below these setae also with shorter, stouter apically bifid setae; metatibial spurs similar in shape and length, slender and pointed apically, about two-thirds length of metatarsomere 1. Metatarsomeres dorsoventrally flattened, apical margin slightly emarginate but not distinctly lobed, upper and lower surfaces with flat, decumbent, more or less contiguous pale setae, least dense on metatarsomere 5, apically with setae short and forming a more or less regular transverse apical row. Male and female with metatibia and metatarsomeres with ventral margins fringed with long yellow setae.

Male protarsal palette ventrally with two large circular adhesive suckers at base of protarsomere 1, remainder of surface with numerous long-stalked small round adhesive suckers and laterally fringed with flattened, stout setae. Male genitalia with parameres united dorsally by membrane, almost to apex, parameres symmetrical, narrowed towards apex which bears stout, coarse setae; aedeagus slender, medially ridged ventrally with small apical expansion and reflexion, with a narrow, membranous, subapical lobe on each side. Female gonocoxae elongate, joined medially by membrane almost to apex; each laterally flattened except apex dorsoventrally flattened and with a subapical ventral fovea which bears a pencil of long, slender setae.

Comments. This tribe contains a single genus, *Eretes*, which is cosmopolitan in warm areas of the world.

Genus *Eretes* Laporte 1833

Eunectes Erichson 1832, Gen. Dyt., 17: 23. Type species: *Dytiscus sticticus* Linnaeus 1767, Syst. Nat. Ed. 12, 1: 666, by monotypy. Not Wagler 1830.

Eretes Laporte 1833: 397. Type species - *Dytiscus griseus* Fabricius 1781.

Diagnosis. With characteristics of tribe.

Comments. It has long been thought that *Eretes* contains only two species, *E. australis* confined to Australia, and *E. sticticus* on the other continents and many oceanic islands. However, D. Fancy(1996, unpublished) has shown that the genus contains at least 4 species and that all New World specimens belong to the species *E. occidentalis*, not *E. sticticus*.

These beetles occur in exposed, sun-warmed and often turbid temporary ponds. The insects are strong fliers and often occur at light in localities far removed from breeding habitats. For this reason, the genus is treated here although no Canadian records exist.

Eretes occidentalis (Erichson 1847)

Eunectes occidentalis Erichson 1847: 73. Type locality - Peru.

Eretes sticticus auctorum, not Linnaeus 1767. Crotch 1873: 386. Leng 1920: 81. Guignot 1932: 666. Leech 1948: 415. Young 1954: 112. Leech and Chandler 1956: 322. Anderson 1962: 74.

Description. Length = 12.7 to 16.8 mm; width = 6.7 to 9.2; length: width = 1.76 to 2.07.

Color pale yellow to pale brown. Head dorsally with a large bilobed posterior spot. Pronotum with or without transverse medial bar or series of spots, hind margin with pigmented spots on some specimens. Elytron irrorate with dark spots, each centred on a puncture but larger than puncture; spots of serial punctures coalesced to form three discal series of larger spots; most specimens also with subsutural spots coalesced to form a line; a subapical transverse fascia present but poorly developed on some specimens; a discal spot present sublaterally near middle.

Sculpture of elytron consisting of variously effaced, fine microreticulation, micropunctures (subequal in diameter to meshes of microreticulation or smaller) evident or not; with more or less equally spaced larger punctures. Metacoxal plates finely microreticulate, with numerous fine, transverse strioles; abdomen with strioles strong and oblique anterolaterally, finer and transverse medially and apically.

Ecology. Young (1954) concluded this is an insect of temporary pools or ponds in dry regions. Kingsley (1985) described aspects of the life history and dispersal of the species in Arizona.

Distribution. The range extends from the southern United States (Florida to Kansas, Utah and California) south to Peru as well as on Carribean islands and the Galapagos Islands.

Tribe Cybistrini Sharp 1882

Diagnosis. Size large to very large, length = 13 to 47 mm. Body oval, somewhat wedge-shaped with maximum width well behind middle, body anterior to point of maximum width more or less evenly narrowed to relatively small head, posterior part of body broadly rounded.

Color of dorsal surface rufous to black with a greenish cast on many specimens; many specimens with front of head and lateral margins of pronotum and elytra, yellow.

Clypeus with anterolateral fovea deep, well separated from anterior margin. Eye large, anterior margin entire. Antenna slender. Pronotum without lateral bead; posterolateral angle right-angled to acute, closely encompassing base of elytron. Prosternum in lateral aspect with anterior margin abruptly raised, prosternal process flattened and broadly convex in cross-section, apex sharply pointed and flushly received into a sharply incised notch on metasternum. Metasternum and metacoxae very large, together making up more than one-third total length of body; metasternal wing with lateral portion narrow and tongue-shaped, outer margin arcuate, apically separated from elytra by mesepimeron; metacoxal lines present or obsolete. Fore and middle legs relatively small. Hind legs robust, broad; metatibia short and broad, about one half length of metafemur and about 1.2 to 2× as long as wide; metatibial spurs longer than metatarsomere 1, outer spur broadened basally; metatarsomeres large, dorsoapical margin lacking fringe of pale flattened setae; male with natatorial setae on mesal face of metatibia and outer margin of metatarsomeres 1 to 4, these setae lacking from female; metatarsus with claws unequal or with a single claw. Sternum 6 with hind margin entire or variously emarginate; with or without a distinct marginal bead.

Male protarsomeres 1 to 3 strongly dilated, forming a transversely elliptical palette; ventrally with four transverse rows of oval adhesive scales; margins of palette densely fringed with stout ventrally directed setae; male mesotarsi not dilated, with or without ventral tufts of setae. Parameres narrowly triangular, sclerotized, setose mesally and apically; aedeagus various, apex in ventral aspect truncate or pointed to bifid.

Comments. This tribe is most diverse in tropical areas of the world. Diversity decreases with latitude and only one species is known from Canada. In this respect, the distribution of cybistrines is complimentary to that of *Dytiscus* but similar to that of *Hydrophilus* (and related genera of large hydrophilids). The tribe is represented in the New World by two genera: *Cybister* with species in southern North America, Central America and the Caribbean; and *Megadytes* which is primarily South American with one species extending north into Florida.

These beetles are very heavily sclerotized, streamlined, strong swimmers. They generally occur in deeper, more open water than most other dytiscids (Larson 1997*c*), possibly because they are less vulnerable to aquatic predators. Many of the species frequently collected at light and it is likely that with these strongly flying insects extralimital records occur due to long distance flight dispersal.

Genus *Cybister* Curtis 1827

Cybister Curtis 1827: 151. Type species - *Dytiscus lateralis* Fabricius 1798 (= *Cybister tripunctatus* Olivier 1795). Nilsson *et al.* (1989) and Pederzani (1995) discuss type designation and subgenera.

Diagnosis. Dytiscinae with characteristics of tribe Cybistrini. North American species with size large, length = 26.0 to 34.0 mm. Dorsal surface piceous to black with a greenish reflection; front of head and lateral margin of pronotum and elytra yellow. Metacoxal lines present. Male metatarsus with a single claw; female metatarsus with a single claw or with a second rudimentary claw lying in ventral notch at base of larger claw.

Comments. Members of this genus resemble one another very closely in most characteristics, differing externally primarily in color, size and shape. Therefore it is not surprising that the taxonomy of these large, conspicuous insects is not well understood. Brinck (1945) and Guignot (1961) have proposed a number of subgenera but various authors, including Omer-Cooper (1965) and Pederzani (1995) have doubted the justification for some of these taxa. The Nearctic species are best assignable to *Cybister s. str.*

Males of some species have a stridulatory organ which consists of a series of coarse ridges on the metacoxa close to the insertion of the hind leg and a short ridge or plectrum on the adjacent portion of the base of the metafemur. Males of all North American species have 3 to 5 coarse ridges just anterior to the metacoxal fossa. These ridges are lacking from Old World species although members of the *C. senegalensis*-group have the anterior border of the metacoxal fossa with fine transverse ridges (Guignot 1961). The presense of a characteristic male stridulatory organ indicates a monophyletic origin of the New World species.

Key to species of *Cybister* of North America

1. Metafemur with posteroapical angle drawn out as an acute spine; female with a single metatarsal claw, without sexual sculpture of longitudinal strioles on elytra but head and pronotum laterally with anastomosing lines; Nevada and California . . . . *C. explanatus* LeConte 1851

1'. Metafemur with posteroapical angle right-angled or acute but not produced as a narrow spine; female metatarsus with one or two claws, sexual sculpture present or not 2

2(1). Elytron with yellow lateral margin narrower, apically narrowed and terminating at sutural angle; female with two metatarsal claws, the second very small; female elytron with dense longitudinal strioles; widespread . . . . .1. *C. fimbriolatus* (Say)

2'. Elytron with yellow lateral margin broader, yellow extending to apex and encompassing entire sutural angle; female with one or two metatarsal claws; female elytron with or without sexual sculpture 3

3(2). Size larger, Length = 30.0 to 34.0 mm; female with a single metatarsal claw; female elytron with sexual sculpture; Florida . . . . *C. occidentalis* Aubé 1838*b*

3'. Smaller, Length = 26.0 to 30.0 mm; female with a small second metatarsal claw; female elytron lacking sexual sculpture; Texas to California . . . . *C. ellipticus* LeConte 1851

1. *Cybister fimbriolatus* (Say 1823)

Dytiscus fimbriolatus Say 1823: 91. Type locality - Pennsylvania.

Selected References. Young 1954: 120 – 121; Michael and Matta 1977: 42 – 44; Hilsenhoff 1993*a*: 39.

Description. Length = 26.0 to 33.0 mm.

Color piceous to black with a greenish sheen (due to numerous tiny green spots) on most specimens. Head anteriorly, pronotum laterally and elytron laterally, yellow; yellow lateral margin of elytron complete but narrowed and terminating on apical angle (very narrowly so along sutural margin on some specimens) so that yellow margin is not continuous around both elytra.

Female with head and pronotum laterally with coarse anastomosing lines, elytra with sharply impressed longitudinal strioles on at least basolateral portion, on many specimens present over most of disc except absent or sparser towards sutural margin.

Male with a single metatarsal claw; female with two metatarsal claws, one conspicuous, the other very small and lying in an emargination of metatarsomere 5 ventral to the larger claw.

Male stridulatory file on metacoxa with three or four ridges.

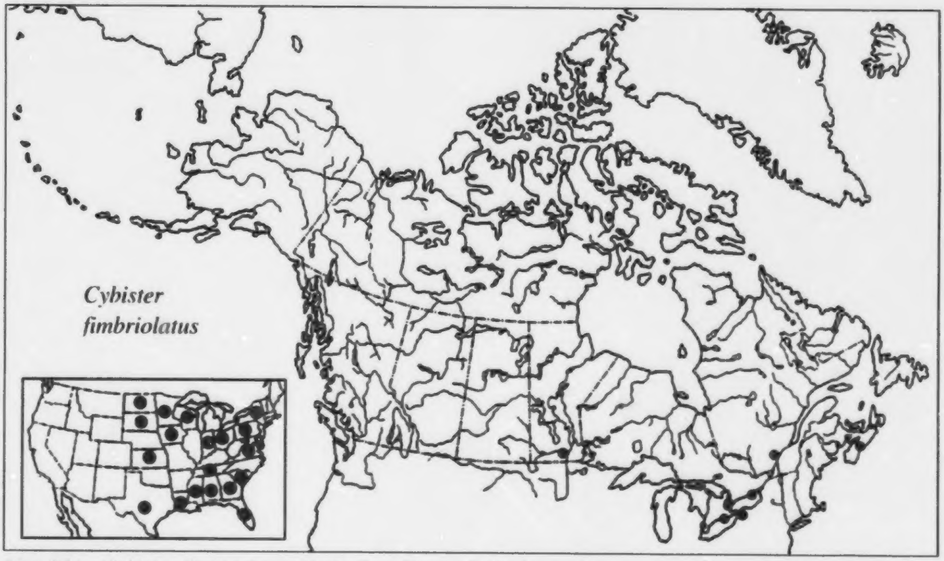
Comments. This species is represented in the United States by two subspecies: *C. f. fimbriolatus* which has a wide range in the east; and *C. f. crotchi* Wilke which occurs along the Atlantic coast from Virginia to Florida and west to Louisiana. Michael and Matta (1977) give a key to subspecies and discuss the problem of their recognition.

The species *C. flavocinctus* Aubé 1838, recorded from Mexico and Texas, is unknown to us. Sharp (1882*a)* noted that it is very close to *C. fimbriolatus*, not differing in male characters but being more parallel in outline and with the yellow lateral band of the elytron more distinct apically and nearly or actually reaching the sutural margin at the elytral apex. *Cybister fimbriolatus* is variable in these characteristics and it is possible that *C. flavocinctus* is a junior synonym.

The species *C. ellipticus* is very similar in male genitalia to *C. fimbriolatus* and may represent a western form with more broadly pale lateral margins and reduced female sexual sculpture.

Ecology. Young (1954) stated that in Florida the species occurs in the deeper parts of ponds, ditches and similar situations. DJL collected many specimens from the outer margin of the emergent zone of permanent but fishless quarry ponds in Texas. These beetles fly readily and are often collected at light.

Distribution. Map 274. The species occurs throughout eastern United States, east of the Great Plains. Single specimens have been collected from several localities in Canada including Halifax, Nova Scotia, several localities in southern Ontario, Carman, Manitoba, Ft. Smith, Northwest Territories and Victoria, British Columbia. Hilsenhoff (1993*a)* recorded larvae from Wisconsin but there is no evidence the species breeds in Canada and records (at least outside southern Ontario and Quebec) probably represent dispersing individuals, specimens transported by humans or mislabelling (unlikely as most are by reputable collectors).



Map 274. *Cybister fimbriolatus* (Say). Canadian and Alaskan collection localities and United States state records.

PART 3. LARVAE

INTRODUCTION AND SCOPE

Because they are often abundant and are voracious predators, larvae of Dytiscidae have an important impact on the dynamics of aquatic ecosystems in which they occur. However, knowledge of larval ecology is scanty mainly because identification of larval Dytiscidae is difficult. Dytiscid classification and nomenclature has been based primarily on the adult stages and it has been through the association of larvae with adults that a system of larval identification has been developed. Within the Nearctic fauna, less than 20 percent of the species have larval and adult stages associated although larvae of most genera are known.

Larvae often show conspicuous differences both at the subfamily and generic level. Recent studies of larval Hydroporinae and Colymbetinae using chaetotaxy and porotaxy (Alarie 1989, 1991*a*, 1991*b*, 1997; Alarie *et al*. 1990*b*; Alarie *et al*. 1997) have shown that good specific characters exist.

This chapter discusses briefly the larval morphology of the dytiscid genera represented in North America. Every genus with known larvae is described and discussed taxonomically. Diagnostic descriptions of genera are based on study of both Nearctic and Palaearctic specimens in order to make them as comprehensive as possible. The treatment of each genus includes a diagnostic combination of characters, where possible a description of each larval instar, and a short discussion of the taxonomic relationships of the genus. Keys for identification of the three larval stages of most genera are also included. We hope that such tools will favor further study of larval morphology and ecology.

TAXONOMIC CHARACTERS and METHODS

Characters and terms. Larvae are very different morphologically from adults and therefore a different set of structures and terms are used in their study. Some terms used in this study are defined below and indicated in Fig. 192.

Head length – total head length measured medially along the epicranial stem.

Head width – greatest transverse distance of the head capsule.

Head length: Head width – index of shape of head.

Antenna – antennomeres labelled A with a number corresponding to the antennomere considered (e.g., A1 for antennomere 1; A3' refers to the distal extension of the sensorium present on antennomere 3.

Mandible toothed – refers to the presence of a distinct notch or bulge on the inner margin of the mandible.

Siphon – refers to the dorsal prolongation of the abdomen segment 8.

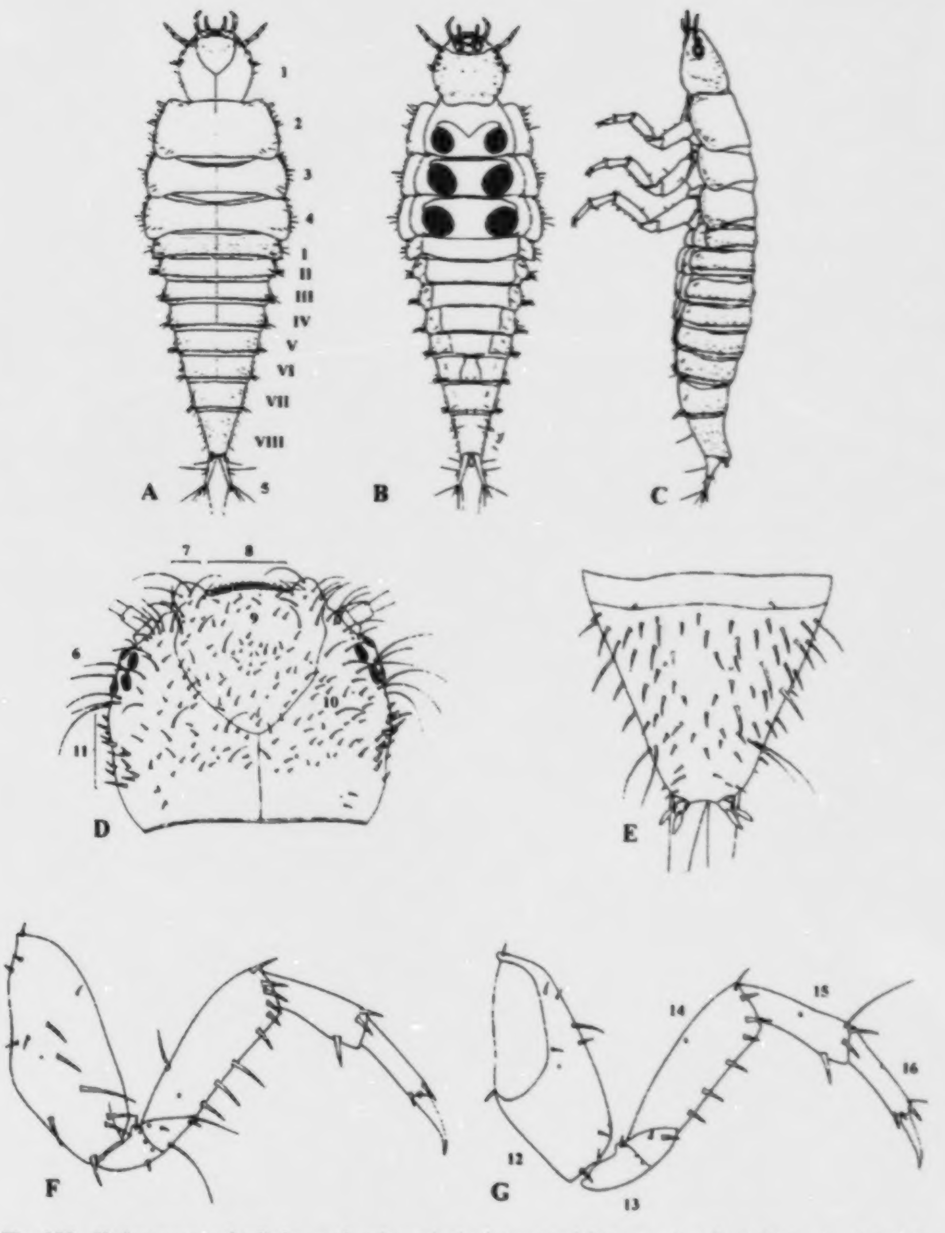

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Fig. 192. *Hydrotrupes palpalis* larva, showing principal structural features. A – C - habitus, A - dorsal, B - ventral, C - lateral. D - head capsule dorsal. E - last abdominal segment dorsal. F – G - metathoracic leg, F - anterior, G - posterior. I - VIII - abdominal segments 1 – 8. 1 - head. 2 - pronotum. 3 - mesonotum. 4 - metanotum. 5 - urogomphus. 6 - stemmata. 7 - adnasalia. 8 - lamellae clypeales. 9 - frontoclypeus. 10 - parietal. 11 - temporal spines. 12 - coxa. 13 - trochanter. 14 - femur. 15 - tibia. 16 - tarsus. Drawn to different scales.

Dorsal length of the last abdomen segment (LLAS) – includes the whole sclerite measured from the anterior margin of the prescutum to the apex of the siphon.

Seta – an articulated contact receptor; depending on its form a seta may be described as spiniform (spine-like) or setiform (hair-like); natatory setae are long, setiform setae present on dorsoposterior and, sometimes, ventroanterior margins of apical segments of legs of some species; primary setae are setae found in instar I and associated with the ancestral pattern; additional setae are those evolved secondarily in the instar I; secondary setae are those evolved in instar II and instar III.

Spinula – non articulated cuticular spines.

UR1-UR8 – refers to the basic pattern of primary setae on urogomphi of Dytiscidae as proposed by Alarie and Harper (1990) and Alarie (1995*b*).

Recognition of larval instar. Larval instar is usually easy to recognize. Except for *Cybister*, an instar I larva always has distinctive egg-bursters on the posterodorsal portion of the frontoclypeus whereas egg-bursters are lacking in instar II and III larvae. The only reliable way for distinguishing instars of *Cybister* is by using measurements.

The presence of spiracles on the lateral margin of the mesothorax and abdomen segments 1 to 7 helps to distinguish instar III from instar II larvae. The only exception are members of the genera *Neoporus* and *Heterosternuta* which also lack spiracles in instar III. However, in these genera the presence of a posterotransverse carina on the thoracic segments of instar III larvae distinguishes them from instar II (Alarie 1991*a).*

Key to families of Hydradephaga of Canada and Alaska

The larvae of Adephaga may be distinguished from those of other families of Coleoptera (except Cupedidae and Micromalthidae) by their possession of a 5-segmented leg (excluding the pretarsus). Other beetle larvae have a 4-segmented leg. Larvae of the five North American families of Hydradephaga can be separated by means of the following key.

1. Abdomen with 8 segments; pretarsus with 2 claws. 2

1'. Abdomen with 10 segments; pretarsus with 1 or 2 claws. 4

2(1). Thorax and abdomen with terga produced laterally to form plate-like processes; abdomen segment 8 with spiracles dorsally positioned; in mountain streams of western North America . . . . .Amphizoidae

2'. Thorax and abdomen with terga not produced laterally to form plate-like processes; abdomen segment 8 with spiracles positioned ventrally or apically; in streams, lakes, and ponds of North America 3

3(2). Legs fossorial, slightly visible or not in dorsal view; antenna short, less than half as long as head width; urogomphi minute; last abdomen sternum with inverted U-shaped membranous area . . . . .Noteridae

3'. Legs ambulatory or natatory, distinctly visible in dorsal view; antenna more elongate, more than one-half as long as head width; urogomphi various, usually distinctly visible, if not visible, dorsal terga very lightly sclerotized; last abdomen sternum without U-shaped membranous area .... Dytiscidae

4(1). Abdomen segments 1 to 8 with a pair of lateral gills, segment 9 with 2 pairs; abdomen segment 10 with 2 pairs of hooks; pretarsus with 2 claws; maxillary palp 4-segmented; labial palp 3-segmented; dorsal body surfaces smooth .... Gyrinidae

4'. Abdomen segments 1 to 9 with lateral gills absent; abdomen segment 10 without hooks; pretarsus with 1 claw; maxillary palp 3-segmented; labial palp 2-segmented; dorsal body surfaces sclerotized, granulate or spinose .... Haliplidae

GENERAL MORPHOLOGY OF DYTISCIDAE LARVAE

Dytiscid larvae are characterized by well-developed 5-segmented legs (excluding pretarsus); pretarsus with two claws; terga well-sclerotized; abdomen 8-segmented; and urogomphi normally well-developed.

Body form

Larvae are campodeiform with a strongly sclerotized head capsule and prognathous mouthparts. The body is variously shaped, usually elongate and fusiform (or subfusiform), widest at level of metathorax or middle abdomen. Legs are long and urogomphi are present.

Integument

The larval integument is softer, more flexible and more lightly pigmented than that of adults. The dorsal surface of the body is usually distinctly sclerotized (except *Cybister*), the ventral surface is mostly membranous with sclerotized plates, if present, restricted to apical abdomen segments. Membranous parts of the body are more or less translucent and variously coloured, usually whitish to yellowish or sometimes more brownish or greenish. Sclerites are usually more pigmented than the rest of the body and yellowish, brownish or greyish-black. Colour patterns occur on the head capsule and terga of many specimens.

In most dytiscid larvae, the integument is relatively smooth and the vestiture consists of scattered setae of various shape (hair-like, spine-like) and number. Secondary setae on the dorsal surface of body may be more abundant in instar III. Instar I have spinula over the entire surface of dorsal sclerites.

Head capsule

The head capsule is strongly sclerotized and of varied shape, such as triangular, subquadrate, subrectangular, subtrapezoidal, rounded or pyriform. It articulates with the prothorax at the occipital foramen which is usually circular in shape. Aciliini and Eretini differ from other Dytiscidae in having the occipital foramen extensively indented both dorsally and ventrally (Fig. 222A, E).

The head capsule is divided above by a Y-shaped epicranial suture (Fig. 199A, C) which delimits a frontoclypeal region and two lateral epicranial plates behind and lateral to the frontal arms and on either side of the epicranial stem. The epicranial suture is usually complete, extending anteriorly from the posterior margin of the head capsule to, or nearly to, the antennal insertions. An occipital suture may be present (Fig. 201A). This suture crosses the back of the head capsule, intersecting the stem of the epicranial suture at a right angle. Laterally, the occipital suture terminates at the side of the head or, more ventrally, proximad to the gular sutures.

The frontoclypeal region lacks a labrum. The anterior margin of the frontoclypeus is usually moderately arcuate (Figs. 212; 213; 218 – 224) but in some groups (Hydroporinae), it extends anteriorly forming a median projecting lobe called the nasale (Figs. 199 – 205; 207; 209 – 211). The ventroapical margin of the frontoclypeus usually bears setae of various number and shape (*lamellae clypeales* of Bertrand (1928, 1972)) (Figs. 212A; 220). These setae occur throughout the family with the exception of *Cybister* where they are lacking. Instar I larvae of most taxa possess a spine-like tubercle or egg-burster (*ruptor ovi* of Bertrand (1928, 1972)) on the posterior region of the frontoclypeus proximad to the frontal arms of the epicranial suture (Figs. 204A; 212A). Members of the Laccophilinae have numerous asperities instead of a spine-like tubercle. Eggs-bursters are lacking within *Cybister*.

The head capsule laterally consists of an epicranial plate (parietals) and, medioventrally, a gular plate. Each parietal bears an antennal fossa, six stemmata (absent from subterranean forms), and, in instar II and III of many groups, a series of strong spine-like setae or temporal spines. The gula is usually narrow, delimited from the two epicranial plates by a pair of semicircular gular sutures on which the posterior tentorial pits are usually visible on each side at about midlength (Fig. 199D).

Cephalic appendages

Antennae. The antennae are elongate, arising from an antennal cavity located on anterolateral angle of parietals. Each antenna consists of four antennomeres (Fig. 214A – H); antennomere III apically bears a sensory process which may be short and non-apparent (Fig. 214H) at low magnification (antenna uniramous) or elongate (Figs. 193C; 214F), sometimes as long as the terminal antennal segment (antenna biramous); lack of setae at the apex of the process distinguishes it from antennomere IV. Instar II and/or III of Dytiscinae are characterized by a secondary segmentation of some antennal segments (Figs. 222G; 224H) whereas in *Cybister*, antennomeres are secondarily subdivided from instar I (Fig. 223B).

Visual organs. Six stemmata are usually present but may be lacking in some subterranean forms. They are distributed in two curved rows just behind the antennal cavities. Stemma are of varied size in Aciliini, with two stemmata of the anterior row conspicuously enlarged (Fig. 317A, B). Members of Dytiscinae (except *Cybister*) posses a rudimentary visual organ of unknown function situated right behind the postero-dorsal stemma.

Mandibles. Mandibles are well-developed, narrow and falcate. Mandibles of Hydroporinae are distinctive with the inner margin curved inward and upward apically but moving in a horizontal plane as in the rest of the family. Most taxa with mandibles grooved mesally or perforate, that is with the groove closed except for an apical and a basal opening, adapted for a liquid mode of feeding. *Copelatus* and *Hydrotrupes* larvae lack a mandibular channel.

Maxilla. Maxilla usually consists of a small basal cardo, a larger stipes, a palp of three palpomeres borne on a palpifer, and a palpiform galea (more falcate in *Copelatus*) hinged to the inner margin of the stipes. Some taxa with two (Laccophilinae, part of Colymbetinae) (Figs. 195D; 212D; 214P, R) or three (Copelatinae) (Fig. 193E) hook-like spines behind the galea, these structures interpreted by some authors as a lacinia. In some Hydroporinae, the cardo is fused to the stipes (Fig. 196G). The galea is lacking among Hydroporinae (Fig. 196E – G) and *Cybister* (Fig. 223C)

The stipes constitutes the main body of the maxilla. It is usually longer than wide but of various shape (conical, cylindrical, palpiform). In some larvae, its inner margin is heavily setose (Fig. 222H). The palpifer, which may be restricted to a shelf-like process, is located near the apex of the stipes and bears the palpus. There has been considerable confusion about the number of maxillary palpomeres, the basic number of segments being three. However, the palpifer may appear to be a basal palpomere, and some Dytiscinae larvae have a secondary segmentation which increases the apparent number of palpomeres (Figs. 222H; 224J). *Cybister* is unique among them in having secondary segmentation in instar I instead of only in instar II and/or III (Fig. 223C).

Labium. The labium consists of three major parts; the basal postmentum, the apical prementum (sometimes called mentum), and a pair of labial palps. The prementum of Aciliini, Eretini, and Cybistrini has a distinct, variously shaped ligula distally between the palps (Figs. 222C, F; 223C). Larvae of *Hydaticus* have distinctive protrusions on the inner margin of the prementum. The labial palp is attached to the prementum by a small palpiger. Basically the labial palp is composed of two palpomeres except for some Hydroporinae (*Macrovatellus*, *Paroster*) which have three. Larvae of *Dytiscus* (instar II and III) (Fig. 224I) and *Cybister* (instar I-III) (Fig. 223C) have labial palpomeres secondarily subdivided.

Thorax and legs

Thorax. The thorax consists of three segments, the pro-, meso-and metathorax, each of which bears a pair of articulated legs. The prothorax, the largest, is longer than wide; the meso- and metathorax are wider than long. Each segment has a large dorsal tergite and, on most specimens, a pair of smaller laterotergites associated with each leg attachment. Each tergum is usually divided at the midline by a narrow ecdysial suture. The ventral region of the thorax is membranous except for a small sclerotized plate or presternum on the prothorax. In larvae of *Cybister*, the presternum is subdivided into two distinct plates.

The protergum is usually simple, consisting of a sclerotized plate in instar I and II; instar III usually with a posterior transverse carina delimiting a narrow postscutellum; transverse carinae occur more commonly on the meso- and metaterga. Instar I and II with an anterotransverse folding subdividing terga into a prescutum and scutum. Where present, the tergal transverse carinae are outlined by a fringe of setae of various size and number.

Instar III (except *Heterosternuta* and *Neoporus*) are characterized by the presence of a pair of spiracles located on the mesopleural region. An additional pair of non-functional spiracles occurs on the metapleuron in some Dytisicinae (Dytiscus).

Legs. Legs are usually long and slender, the prothoracic legs shortest, the meso- and metathoracic pairs progressively longer. Legs with five segments as follows, from base to apex, coxa, trochanter (always subdivided into two parts), femur, tibia, and tarsus which apically bears the pretarsus, and a pair of claws articulated on a very small empodium. Coxa and femur are the longest, and trochanter the smallest segments. Larvae of the genus *Matus* (Colymbetinae), have the ventral margin of both the pro- and mesotibia extended under the tarsus forming a pseudo-chelate leg (Fig. 221C, E). Tarsal claws are usually unequal in length, the anterior claw is longer than the posterior claw on pro- and mesothoracic legs and slightly shorter on metathoracic legs.

Legs possess cuticular structures of various shape and number. Recent studies (Nilsson 1988; Alarie *et al.* 1990; Alarie 1995*b)* have shown consistent patterns of primary sensilla on the legs of instar I. These patterns are consistent enough to be used for phylogenetic analysis and yet sufficiently diverse to be of value in recognition of taxa. Some larvae possess long setiform setae (natatory setae) in a single or double row (Dytiscinae) on the tarsi, tibiae, and, sometimes, femora (Figs. 203G; 206B, D; 209D; 210E; 223D; 224K). Natatory setae are usually developed secondarily except in Dytiscinae where they are present from instar I (Fig. 224E). Spinulae are well-developed along the ventral margin of tibiae and tarsi (present but more lightly developed on femor) where they often look like spine-like setae.

Abdomen and Urogomphi

The Abdomen is subcylindrical and consists of eight visible segments; segments 1 to 7 similar in form, segment 8 variously modified for respiration. Each segment with dorsum usually consisting of a large median plate which extends laterally slightly over the pleura. However larvae of *Cybister* are unique in having segments 1 to 6 mostly membranous except for three small plates, one median and two lateral, anterodorsally (Fig. 223A). Tergal plates may possess transverse carinae; an anterotransverse carina separates a prescutum from the scutum and a posterotransverse carina delimits normally a postcutellum on segments 1-7 of instar III; each transverse carina bears a fringe of setae. Segment 8 with tergal plate usually extending posteriorly well beyond the origin of the urogomphi (except in *Cybister*) forming a prolongation of the segment called the siphon. The lateral margins of the segments 7 and/or 8 bear a fringe of long natatory setae in Coptotomini and Dytiscinae (Figs. 222D; 223A; 224A, F; 235B).

Ventral surface of abdomen segments variously sclerotized. Segment 8 (except *Copelatus*) completely and heavily sclerotized in instar I but the degree of sclerotization on other abdomen segments various depending on instar and species. Eight pairs of spiracles are present on the abdomen. The first seven pairs functional only in instar III except in the genera *Neoporus* and *Heterosternuta* where they are absent throughout the larval stage. Spiracles are usually located laterodorsally on, or proximad to, the tergal plates. Spiracles of segment 8 are borne dorsally at the apex of the siphon, these being the only spiracles functional throughout the larval stage. The larvae of Coptotomini are unique in possessing long lateral gills on each of segments 1 to 6 (Fig. 235B)

Abdomen segment 8 bears a pair of terminal (or subterminal) articulated urogomphi. These consist of one or two segments (Fig. 217) but an additional subbasal suture is secondarily developed on the urogomphi of some Colymbetinae. Each urogomphus bears eight primary setae (Alarie and Harper 1990; Alarie 1995*b)* except *Cybister* which have only four primary setae because of the highly reduced size of the urogomphi (Fig. 223A). Some larvae have secondary setae on urogomphi of instar II and III (Figs. 195E; 203E; 204D; 205I; 208E – G; 210G; 220G, H). Larvae of *Dytiscus* (Dytiscinae) have a fringe of natatory setae on the lateral margin of the urogomphi (Fig. 224A, F).

Key to subfamilies of North American Dytiscidae

1. Frontoclypeus developed anteriorly into a frontal projection or nasale (Fig. 199A, C); apex of mandible distinctly curved upward; maxillary galea and palpifer absent (Fig. 196E – G); urogomphus 2-segmented (Fig. 198) . . . . .Hydroporinae, p. 849

1'. Frontoclypeus not developed anteriorly into a frontal projection or nasale (Fig. 193A, B), at most with a short bilobate or trilobate process (Fig. 223B); apex of mandible not curved upward; maxillary galea and palpifer present (Figs. 193E; 195D; 214P – S); urogomphus 1- or 2 segmented (Fig. 217) 2

2(1). Anteroventral margin of femur and tibia with a fringe of natatory setae (Fig. 224E, K); lateral margins of abdomen segments 7 and 8 with a fringe of natatory setae (Figs. 222D; 223A; 224A, F); large size species . . . . Dytiscinae, p. 914

2'. Anteroventral margin of femur and tibia lacking a fringe of natatory setae; lateral margin of abdomen segment 7 lacking a fringe of natatory setae; lateral margin of abdomen segment 8 with natatory setae present (instar II and III only) or absent; small to medium size species 3

3(2). Abdomen segments 1 to 6 with a pair of lateral tracheal gills (Fig. 235B); fronto-clypeus with a pronged extension anteromedially; lateral margin of abdomen segment 8 with a fringe of natatory setae in instar II and III ; antenna elongate, distinctly longer than head length; urogomphus with numerous additional setae . . . . .Colymbetinae, Coptotomini, 913

3'. Abdomen segments 1 to 6 lacking lateral tracheal gills; frontoclypeus lacking a pronged extension antero-medially; lateral margin of abdomen segment 8 lacking a fringe of natatory setae; antenna shorter, at most slightly longer than head length; urogomphus with additional setae present or absent 4

4(3). Urogomphus fairly small, almost vestigial, less than 0.20 times as long as LLAS (Fig. 194D); maxillary galea spine-shaped; abdomen segment 6 fully sclerotized ventrally (known as instar III only) .Agabetinae, p. 845

4'. Urogomphus more elongate, at most slightly shorter than LLAS; maxillary galea finger- or hook-shaped; abdomen segment 6 usually membranous ventrally 5

5(4). Maxillary galea hook-shaped (Fig. 193E); mandible not channelled, with a double- row of strong teeth along inner margin (Fig. 193D); legs with natatory setae absent; urogomphus 1-segmented Copelatinae, p. 842

5'. Maxillary galea finger-like; mandible channelled (except *Hydrotrupes*), at most minutely serrated along inner margin; legs with natatory setae present or absent; urogomphus 1- or 2 segmented 6

6(5). Urogomphus 1-segmented (Fig. 217E–J) .. Colymbetinae, in part, p. 891

6'. Urogomphus 2-segmented (Fig. 217A–D) 7

7(6) Antenna biramous (Fig. 214E, F); urogomphus with many secondary setae (Fig. 195E); frontoclypeus with strong submedian constriction, proximally truncate, with only two clypeolabral setae, and with egg-bursters positioned posteriorly (instar I) (Fig. 195A) Laccophilinae, p. 846

7'. Antenna generally uniramous (Fig. 214G, H); urogomphus generally lacking secondary setae (Fig. 218C); frontoclypeus more triangular in outline, with at least four clypeolabral setae (Fig. 219A) and with egg-bursters positioned anteriorly (instar I) 8

8(7). Siphon with a lateral lobe on each side, each lobe with two lanceolate setae (Figs. 212I; 213E); mandibular channel absent; frontoclypeus with four clypeolabral setae (intar I) (Fig. 212A) .. Hydrotrupinae, p. 887

8'. Siphon lacking lateral lobe and lanceolate setae; mandibular channel present; frontoclypeus generally with more than six clypeolabral seta (Figs. 218D; 219A, E) .... Colymbetinae, in part., p. 891

Subfamily Copelatinae Van Den Branden

Fig. 193

Diagnosis. Medium size; frontoclypeus not developed into a frontal projection (nasale), triangular in outline and with more than six clypeolabral setae in instar I; coronal suture elongate about one-half head length; occipital suture present; mandible not-channelled, not curved upward apically; maxillary galea present, 1-segmented, and hook-like; maxillary palpifer well-developed; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 lacking lateral tracheal gills; abdomen segment 6 membranous ventrally; abdomen segments 7 and 8 lacking a lateral fringe of natatory setae; siphon lacking lateral lobe and lanceolate setae urogomphus 1-segmented, short, subequal in length to LLAS, with primary setae only in instar I.

Genus *Copelatus* Erichson

Fig. 193

Instar I

Head. Head length = 0.65 - 0.71 mm; head width = 0.74 mm; head length: head width = 0.93; **head capsule** (Fig. 193A) subquadrangular, lateral margins subparallel, slightly rounded posteriorly; about as long as broad; cervical region well-delimited, temporal angle well-marked (i.e., lateral margin distinctly constricted posteriorly); occipital suture present; epicranial suture well-developed, coronal suture about 0.50x as long as head length; frontoclypeus not developed anteriorly into a nasale, with anterior margin smoothly convex margined, triangular in outline, with sparse club-shaped clypeolabral setae, with a reduced but distinct lateral lobe on each side; egg-bursters present; occipital foramen deeply indented ventrally, smoothly sinuate dorsally; stemmata subequal in size; **antenna** (Fig. 193C): biramous, distinctly shorter than head length; A1 to A3 not secondarily subdivided, A4 distinctly shorter than A3; **mandible** (Fig. 193D) not channelled, not curved upward apically, narrow and sharply falcate, inner margin with a

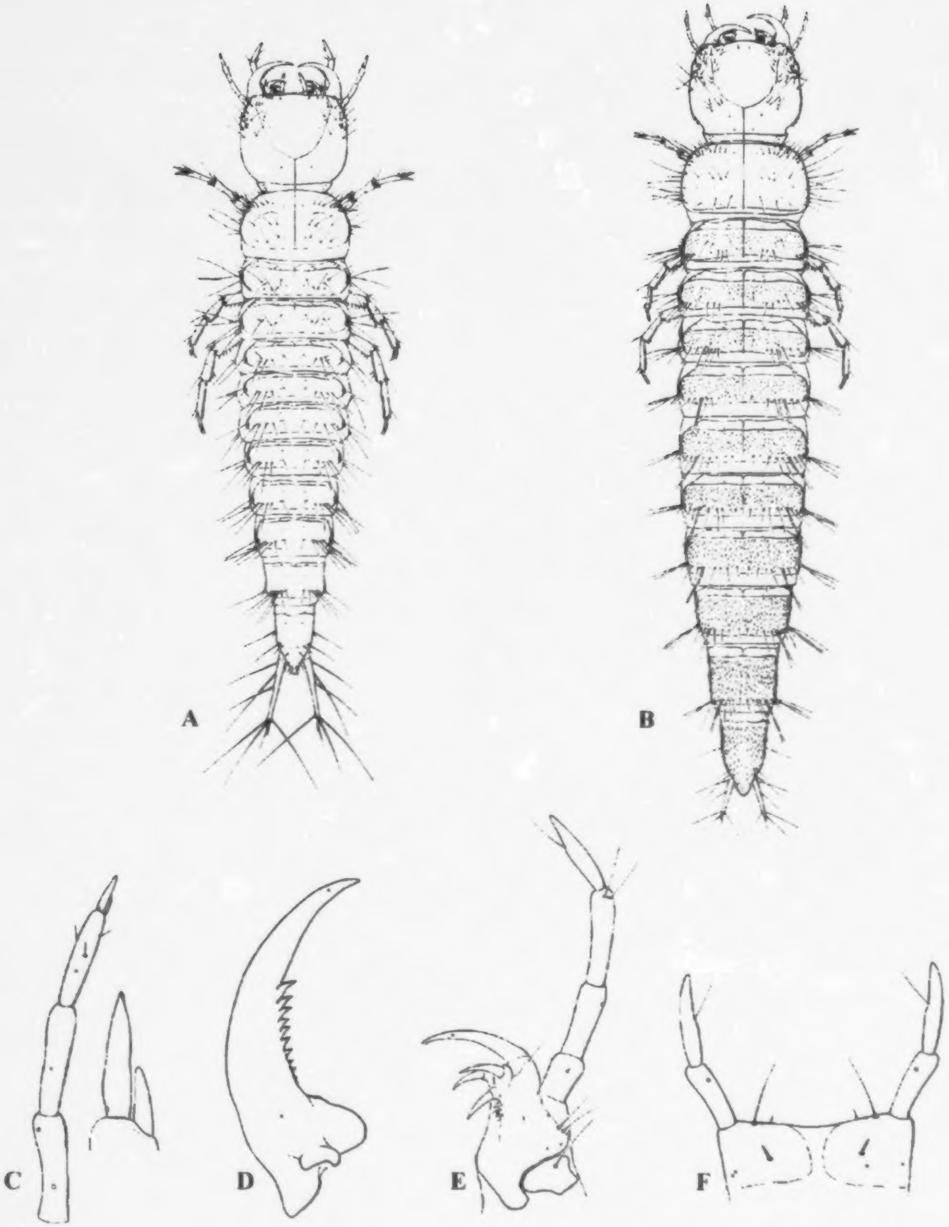

Fig. 1 93. Copelatinae, *Copelatus haemorroidalis*. A, B - dorsal habitus. A - instar I. B - instar III. C – F - dorsal surface of cephalic appendages, instar III. C - antenna,. D - mandible. E - maxilla. F - labium. Drawn to different scales (after De Marzo 1976*a*).

double-row of strong tooth medioapically and lacking hairs; **maxilla** (Fig. 193E): cardo broad, subrectangular; stipes fairly broad, inner margin with 3 hook-like structures distally; galea elongate, 1-segmented, and hook-like; palpifer well-developed, similar to a palpomere; MX1 to MX3 not secondarily subdivided, MX3 subequal to or slightly longer than MX2; **labium** (Fig. 193F): prementum subrectangular, with anterior margin almost straight; ligula absent; LB1 and LB2 not secondarily subdivided, LB2 longer than LB1.

Thorax. Legs: without natatory setae; pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen (Fig. 193A). LLAS = 0.47-0.59 mm, urogomphus L = 0.60-0.73 mm; lacking lateral tracheal gills, fully sclerotized dorsally, membranous ventrally except segment 8 fully sclerotized; segments 7 and 8 lacking a fringe of natatory setae laterally; segment 8 slender, more or less elongate, subcylindrical, lateral margins straight, subparallel to point of insertion of urogomphi, abruptly converging thereafter; siphon short, triangular in outline with lateral margin slightly sinuate, bluntly pointed apically; urogomphus 1-segmented, about 1.20–1.30x as long as LLAS, without subbasal suture, and with only primary setae; setae UR2, UR3, and UR4 about equidistant in position; seta UR8 articulated apically.

Instar II. As instar I except for the following characters:
Head. Head length = 1.05 mm; head width = unknown; head length: head width = unknown; **head capsule**: egg bursters absent; parietals with a few temporal spines posteriorly.

Abdomen. LLAS = 0.60 mm; urogomphus L = 0.65 mm; segment 7 fully sclerotized; urogomphus about 1.10x as long as LLAS.

Instar III (Fig. 193B, C, D, E, F). As for instar II except for the following characters:
Head. Head length = 1.26-1.88 mm; head width = 1.25-1.84 mm; head length: head width = 1.01-1.03.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.78-0.80 mm; urogomphus L = 0.70 mm; segments 1 to 7 each with a pair of spiracles on pleural region; urogomphus about 0.80x LLAS.

Taxonomic notes. Larvae of *Copelatus* are similar to those of lower Colymbetinae (*Agabus*, *Ilybius*, and *Agabinus*) and Hydrotrupinae from which they can be distinguished by the non- channelled mandible (except *Hydrotrupes*) margined internally by a double row of strong teeth (Fig. 193D) and by a hook-like galea (Fig. 193E). Ruhnau and Brancucci (1984) also noted that *Copelatus* larvae may be distinguished from other Dytiscidae by the somewhat small and cone- shaped clypeolabral setae and by abdomen segment 8 which is only half sclerotized ventrally, back to the anal cercal region.

In North America, the mature larva and pupal stages of *C. glyphicus* were described by Spangler (1962).

Subfamily Agabetinae Van Den Branden

Fig. 194

Diagnosis. Small to medium size; frontoclypeus not developed into a frontal projection (nasale); coronal suture elongate about one-half head length; occipital suture absent; mandible channelled, not curved upward apically; maxillary galea present, 1-segmented, and spine-like; maxillary palpifer well-developed; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 lacking lateral tracheal gills; abdomen segment 6 fully sclerotized ventrally in instar III; abdomen segments 7 and 8 lacking a lateral fringe of natatory setae; siphon lacking lateral lobe and lanceolate setae; urogomphus 1-segmented fairly short, less than half as long as LLAS, with only primary setae in instar I.

Genus *Agabetes* Crotch

Fig. 194

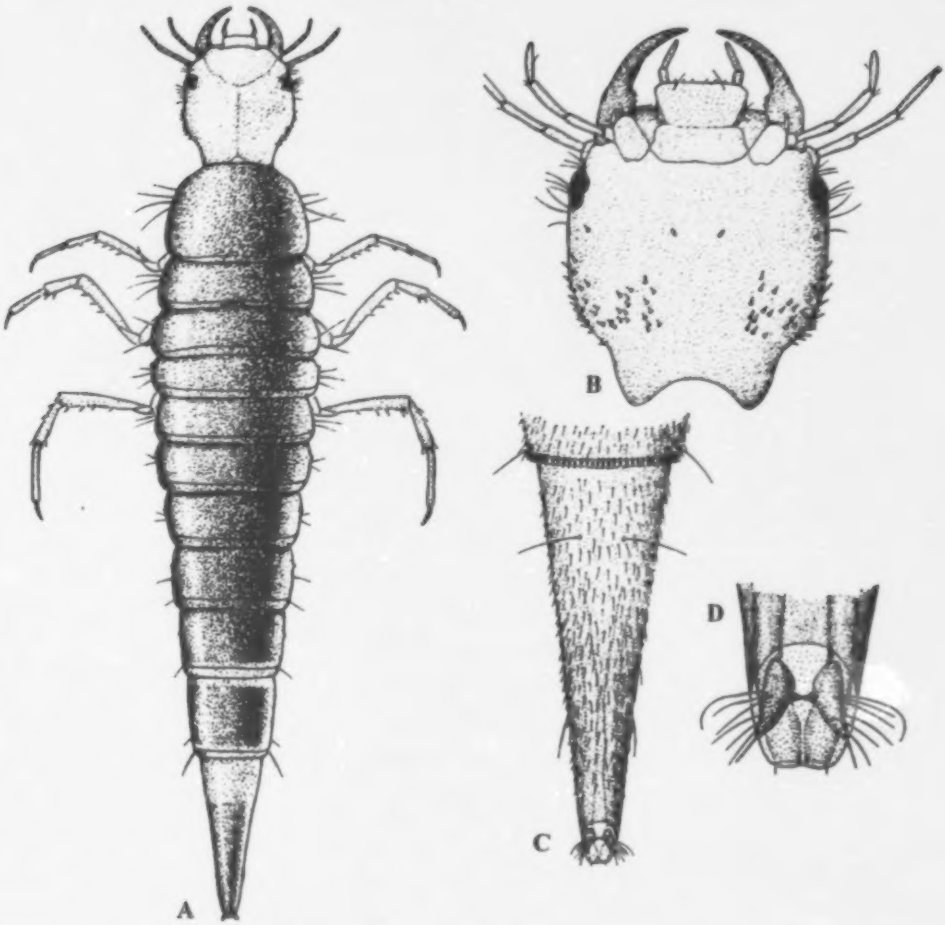

Fig. 194. Agabetinae, *Agabetes acuductus*, instar III. A - dorsal habitus. B - head capsule ventral. C - last abdominal segment ventral. D - urogomphi, ventral. Drawn to different scales (after Spangler and Gordon 1973).

Instars I and II. Unknown.

Instar III.
Head. Head length = 1.32–1.38 mm; head width = 1.18–1.28 mm; head length: head width = 1.10 – 1.15; **head capsule** (Fig. 194A, B) rounded to subquadrangular, with lateral margins slightly diverging posteriorly, slightly longer than broad; cervical region well-delimited, temporal angle well-marked (i.e., lateral margin distinctly constricted posteriorly); occipital suture absent; epicranial suture well-developed, coronal suture about 0.60x as long as head length; frontoclypeus with anterior margin slightly convex, with a lateral lobe on each side, trinagular in outline, anterior margin of frontoclypeus with numerous clypeolabral setae; parietals with numerous temporal spines; egg-bursters absent; occipital foramen indented ventrally, straight dorsally; stemmata subequal in size; **antenna:** biramous, distinctly shorter than head length; A1 to A3 not secondarily subdivided, A4 distinctly shorter than A3; **mandible:** channelled, broad and sharply falcate, not curved apically, inner margin toothed medioapically; **maxilla:** cardo reduced, subtriangular; stipes fairly broad, inner margin, with two spine-like setae apically; galea 1-segmented, short and spine-like; palpifer well-developed, similar to a palpomere; MX1 to MX3 not secondarily subdivided, MX3 shorter than MX2; **labium:** prementum subtrapezoidal, broader than long, anterior margin straight; ligula absent; labial palpomere 1 and 2 not secondarily subdivided, LB2 longer than LB1.

Thorax. Mesothorax with a pair of spiracles on pleural margin; **Legs:** lacking natatory setae; pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen (Fig. 194C, D). LLAS = 1.78–1.81; urogomphus L = 0.13 mm; lacking lateral tracheal gills, fully sclerotized dorsally, membranous ventrally, except segment 6 to 8 fully sclerotized; segments 1 to 7 each with a pair of spiracles on pleural region; segments 7 and 8 lacking a fringe of natatory setae laterally; segment 8 slender, elongate, subconical, lateral margins straight, converging posteriorly from base to apex of siphon; siphon short, narrowly truncate apically; urogomphus 1-segmented, very short and stout, about 0.10x as long as LLAS, lacking a subbasal suture, with only primary setae; setae UR2, UR3 and UR4 usually close together proximally.

Comments. The larval morphology of *Agabetes* is still poorly known since only the instar III larva of *A. acuductus* (Harris) has been described (Spangler and Gordon 1973). *Agabetes* larvae may be distinguished from other Dytiscidae by the combination of: i) reduced size of urogomphi, ii) absence of occipital suture, iii) fully sclerotized abdomen segment 6, iv) absence of natatory setae on legs, and on lateral margins of abdomen segments 7 and 8, and v) by lack of secondary setae on urogomphus.

Subfamily Laccophilinae Bedel

Figs. 195; 236A

Diagnosis. Small size; frontoclypeus not developed into a frontal projection (nasale), with strong submedian constriction and proximally truncate (instar I), and with only two clypeolabral setae in instar I; coronal suture elongate about one-half head length; occipital suture absent in instar II and III; mandible channelled, not curved upward apically; maxillary galea present, 1-segmented, and finger-like; maxillary palpifer well-developed; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; antennomeres 2 and 3, and maxillary palpomeres 2 and 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 lacking lateral tracheal gills; abdomen segment 6 membranous ventrally; abdomen segments 7 and 8 lacking a lateral fringe of natatory setae; siphon lacking lateral lobe and lanceolate setae; urogomphus 2-segmented, elongate, distinctly longer than LLAS, with only primary setae in instar I.

Genus *Laccophilus* Leach

Figs. 195; 236A

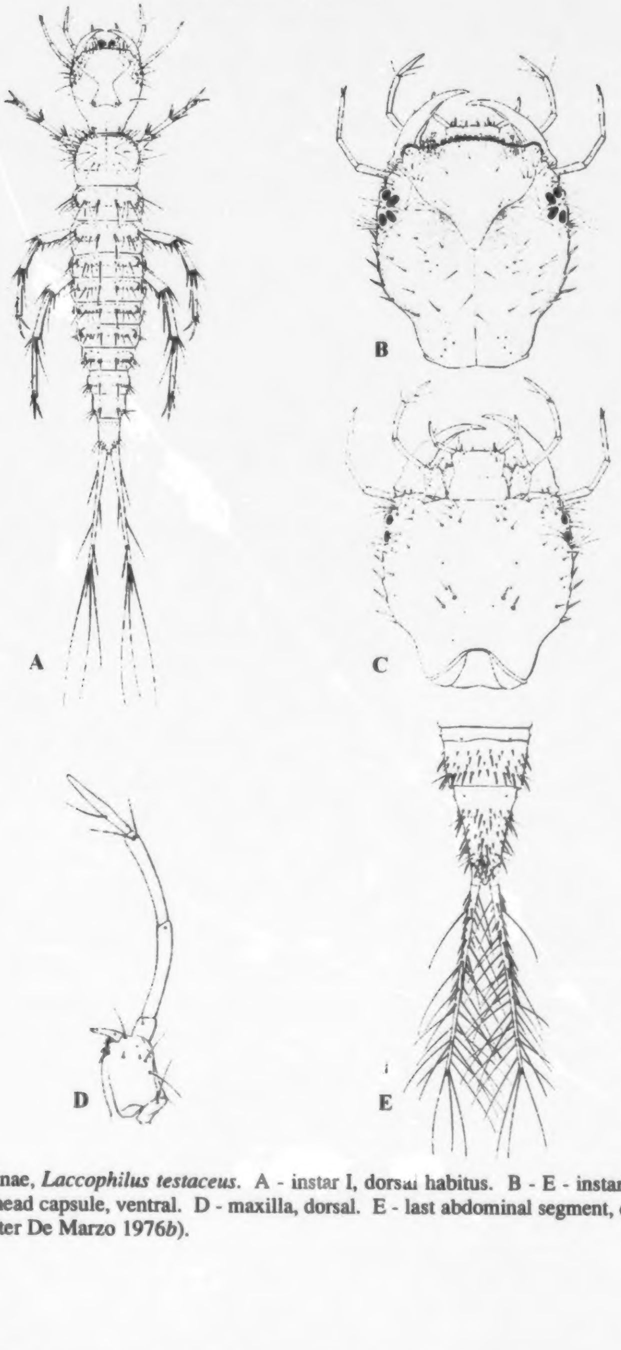

Fig. 195. Laccophilinae, *Laccophilus testaceus*. A - instar I, dorsal habitus. B - E - instar III. B - head capsule, dorsal. C - head capsule, ventral. D - maxilla, dorsal. E - last abdominal segment, dorsal. Drawn to different scales (after De Marzo 1976*b*).

Instar I (Fig. 195A).
Head. Head length = 0.40 – 0.66 mm; head width = 0.34 – 0.55 mm; head length: head width = 1.18 - 1.22; **Head capsule**: rounded to subtrapezoidal, with lateral margin converging posteriorly; slightly longer than broad; cervical region at most weakly delimited, temporal angle weakly marked or not (i.e. lateral margin at most slightly constricted posteriorly); occipital suture absent; epicranial suture well-developed, coronal suture indistinct; frontoclypeus not developed anteriorly into a nasale, with anterior margin convex, lacking a lateral lobe on each side, with strong submedian constriction and proximally truncate, with 2 clavate clypeolabral setae; egg-bursters positioned posteriorly; occipital foramen indented ventrally, straight dorsally; stemmata subequal in size; **antenna:** biramous, distinctly shorter than head length; A1 to A3 not secondarily subdivided; A4 distinctly shorter than A3; **mandible:** channelled, narrow and sharply falcate, inner margin smooth or minutely toothed basally, with a tuft of small hairs apically; **maxilla** (Fig. 195D): cardo reduced, subtriangular; stipes fairly broad, inner margin with 2 hook-like structures basally and with a tuft of hairs near galea; galea 1-segmented and finger-like; palpifer well-developed, similar to a palpomere; MX1 to MX3 not secondarily subdivided, MX3 subequal to or slightly longer than MX2; **labium:** prementum subrectangular, broader than long, with anterior margin straight or slightly concave medially; ligula absent; LB1 and LB2 not secondarily subdivided; LB2 subequal to or longer than LB1.

Thorax. Legs: without natatory setae; pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen. LLAS = 0.20.–0.30 mm, urogomphus L = 0.95–1.10 mm; lacking lateral tracheal gills, fully sclerotized dorsally, membranous ventrally except segment 8 fully sclerotized; segments 7 and 8 lacking a fringe of natatory setae laterally; segment 8 with additional setae absent, slender, more or less elongate, subcylindrical; lateral margins straight, subparallel to point of insertion of urogomphi, abruptly converging thereafter; siphon short, triangular in outline with lateral margin slightly sinuate, bluntly pointed apically; urogomphus 2-segmented, with subbasal suture absent, about 3.60 – 5.20x as long as LLAS; urogomphomere 2 fairly small, distinctly shorter than urogomphomere 1; urogomphus with only primary setae present; primary setae UR2, UR3 and UR4 equidistant in position on urogomphomere 1; primary seta UR8 inserted subapically on urogomphomere 1.

Instar II. As instar I except for the following characters:
Head. Head length = 0.67 – 1.00 mm; head width = 0.63 – 0.78 mm; head length: head width = 1.05 – 1.44; **head capsule**: cervical region well-delimited, temporal angle distinct (i.e., lateral margin distinctly constricted posteriorly); frontoclypeus triangular in outline, with numerous clavate clypeolabral setae, with a small lobe on each side; egg bursters absent; parietals with a variable number of temporal spines; coronal suture visible, about 0.50x head length.

Thorax. Legs: with natatory setae located in a single row on posterodorsal margin of tibiae and tarsi.

Abdomen. LLAS = 0.40–0.50 mm; urogomphus L = 1.50–1.98 mm; siphon relatively shorter than in instar I; segment 7 and 8 fully sclerotized; urogomphus 2.50 to 4.00x as long as LLAS, with secondary setae present.

Instar III (Figs. 195B-E; 236A). As for instar II except for the following characters: **Head.** Head length = 1.00 – 1.46 mm; head width = 0.83 – 1.50 mm; head length: head width = 1.05 – 1.44.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.75 – 0.90 mm; urogomphus length = 1.65 – 2.70 mm; segments 1 to 7 each with a pair of spiracles on pleural region; urogomphus about 1.90 to 3.00x LLAS; urogomphomere 2 present but very short and, sometimes, very difficult to see.

Comments. Morphologically, larvae of the subfamily Laccophilinae are similar to those of lower Colymbetinae (*Agabus* and *Ilybius*). However, larvae of Laccophilinae differ by presence of a biramous antenna (erroneously stated as uniramous in Leech and Chandler 1956 and Merritt and Cummins 1996) and, in instar I, by the reduced number of clypeolabral setae (2) and the shape of the frontoclypeus.

In North America, the larvae of *L. biguttatus* [Watts 1970; Barman 1972; Hagenlund and Nilsson 1985 (as *L. stroehmi* Thomson)], *L. fasciatus* (Sizer *et al.* 1998), *L. maculosus* (Wilson 1923; Watts 1970; Barman 1972), and *L. proximus* (Wilson 1923; Barman 1972) have been described. Hilsenhoff (1992) gives a key to the larvae of the four species known from Canada.

Subfamily Hydroporinae Erichson

Figs. 196-211; 225–231

Diagnosis. Small size; frontoclypeus developed into a frontal projection (nasale), triangular in outline, with more than six clypeolabral setae in instar I; coronal suture short, less than 0.30 head length; occipital suture present in instar II and III; mandible channelled, curved upward apically; maxillary galea absent; maxillary palpifer not visible; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 lacking lateral tracheal gills; abdomen segment 6 membranous or fully sclerotized ventrally in instar III; abdomen segments 7 and 8 lacking a lateral fringe of natatory setae; siphon lacking lateral lobe and lanceolate setae; urogomphus 2-segmented variously elongate, shorter or distinctly longer than LLAS, with only primary setae in instar I.

Instar I.
Head. Head length = 0.32 – 0.74 mm; head width = 0.20 – 0.56 mm; head length: head width = 1.00 – 1.54; **head capsule:** varied in shape, broadly ovate to pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, as long as to longer than broad; cervical region delimited or not, temporal angle distinct or indistinct (i.e. lateral margin constricted posteriorly or not); occipital suture absent or present; epicranial suture well-developed, coronal suture short, about 0.20x as long as head length; frontoclypeus triangular in outline, developed anteriorly into a nasale with lateral notches present or not, anterior margin bluntly rounded with numerous spatulate clypeolabral setae; egg-bursters present and positioned anteriorly; occipital foramen slightly indented ventrally, straight dorsally; ocularium present or absent, if present stemmata subequal in size, subdivided into two vertical series, stemmata of posterior row more widely spaced; **antenna** (Fig. 196A, B): biramous, distinctly shorter than head length; A1 to A3 not secondarily subdivided; A4 distinctly shorter than A3; **mandible:**

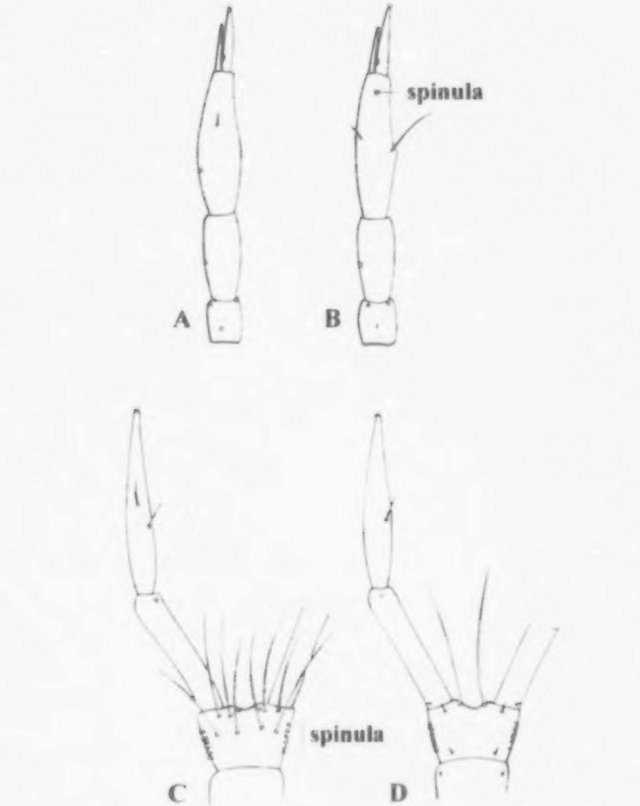
spinula
A
B
spinula
C
D
cardo
E
F
G

Fig. 196. Hydroporinae, cephalic appendages of a generalized larva. A, B - antenna, A - dorsal, B - ventral. C, D - labium, C - dorsal, D - ventral. E, F - maxilla, E - dorsal, F - ventral. G - Oreodytes maxilla, ventral. Drawn to different scales.

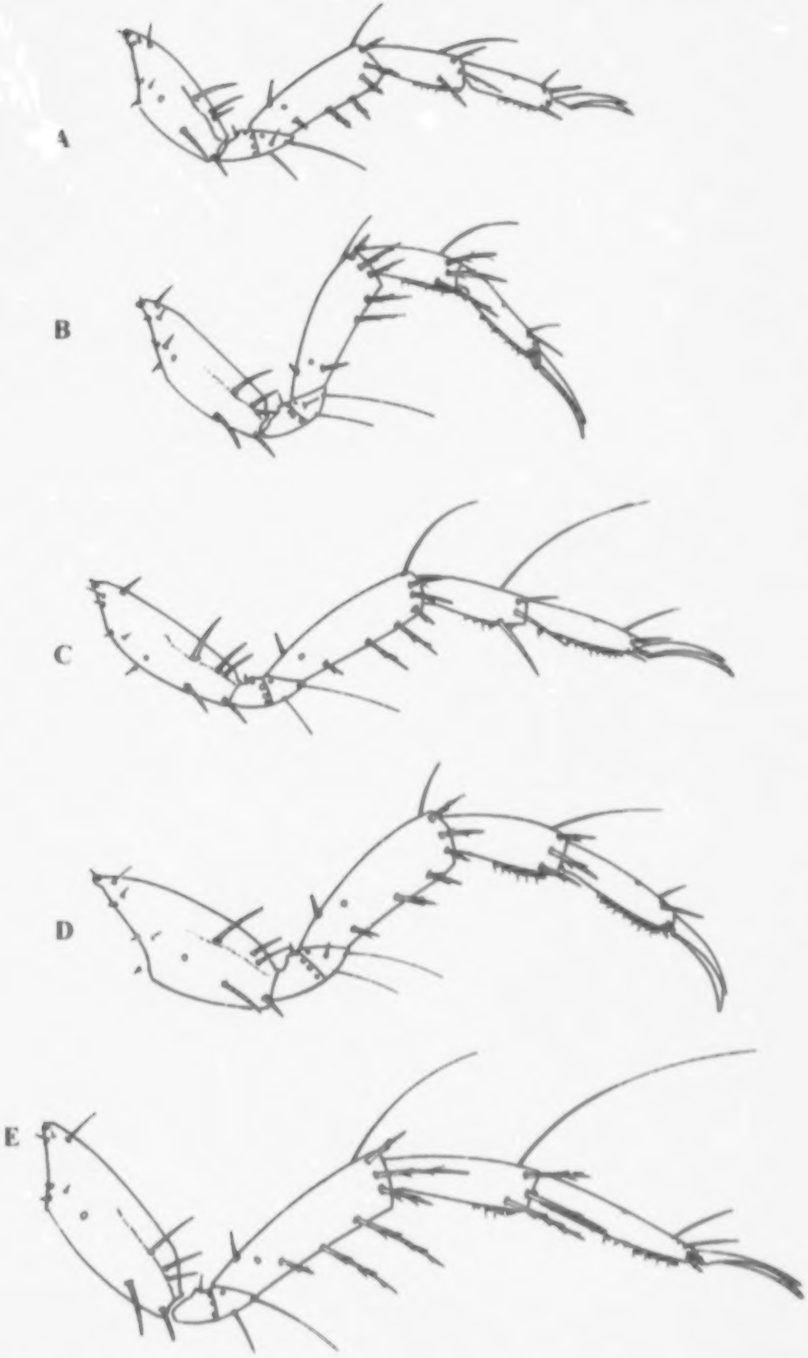

Fig. 197. Hydroporinae, metathoracic leg, instar I, anterior. A - *Hydrocolus paugus*. B - *Hydroporus signatus*. C - *Heterosternuta wickhami*. D - *Hydroporus tenebrosus*. E - *Neoporus undulatus*. Drawn to different scales.

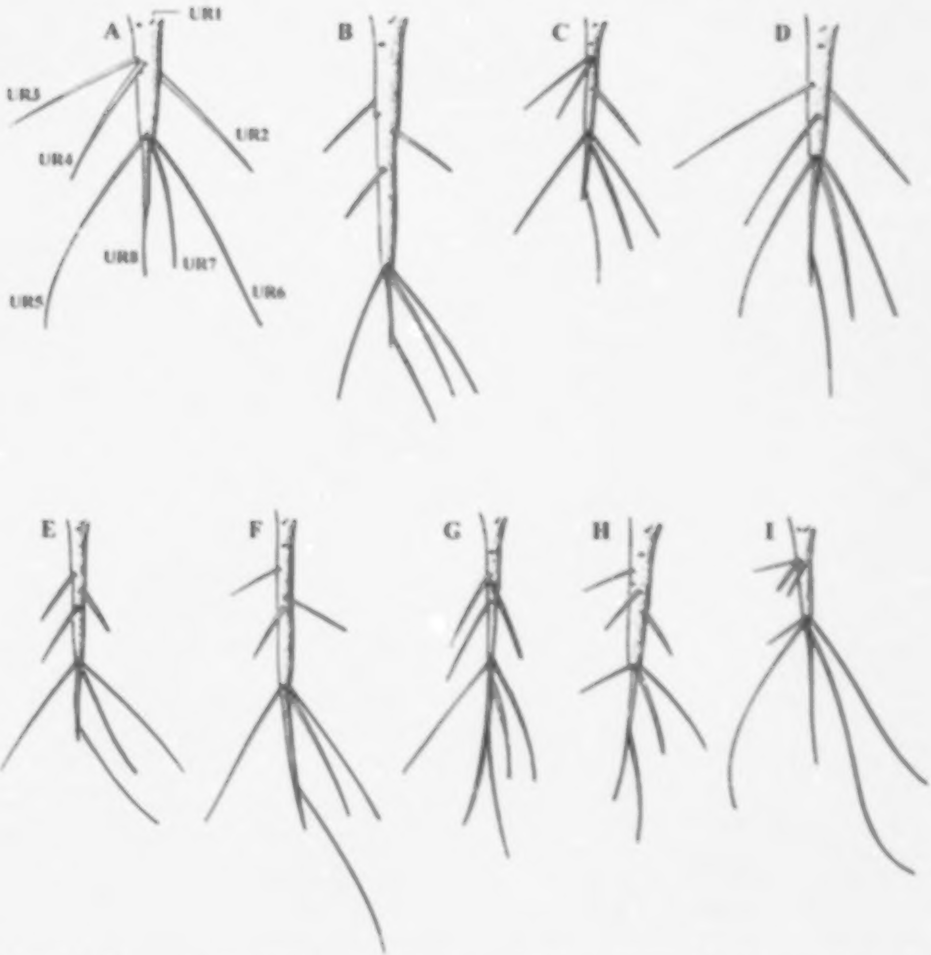

Fig. 198. Hydroporinae, positions of primary setae on urogomphus of instar I. A - *Laccornis latens*. B - *Stictotarsus griseostriatus*. C - *Hydroporus* sp. D - *Hydrocolus paugus*. E - *Neoporus undulatus*. F - *Liodessus affinis*. G - *Hygrotus* sp. H - *Hygrotus masculinus*. I - *Desmopachria convexa*. Drawn to different scales.

channelled, narrow and sharply falcate, curved inward and upward apically, inner margin smooth, not toothed, without hairs; **maxilla** (Fig. 196E - G): with cardo present or absent, if present cardo reduced and ovate; stipes short and thick, with three dorsal setae, one lateral and two ventral setae; galea absent; palpifer not visible; maxillary palp 3-segmented, MX1 to MX3 not secondarily subdivided, MX3 shorter than MX2; **labium** (Fig. 196C, D): with prementum trapezoidal to subquadrate; anterior margin of prementum slightly to distinctly concave medially; ligula absent; labial palp 2-segmented, LB1 to LB2 not secondarily subdivided; LB2 slightly to distinctly longer than LB1.

Thorax. Legs (Fig. 197): without natatory setae; pro- and mesothoracic legs not pseudochelate; tarsal claw lacking basoventral spinulae.

Abdomen (Fig. 198). LLAS = 0.13 – 0.43 mm; urogomphus L = 0.46 – 1.50 mm; lacking lateral tracheal gills, fully sclerotized dorsally, membranous ventrally except segment 7 with a ventral plate well-delimited from reminder sclerite and segment 8 fully sclerotized; segments 7 and 8 lacking a row of natatory setae laterally; segment 8 slender, more or less elongate, and subconical, lateral margin straight to slightly concave, either evenly converging from base to apex of siphon or subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately to very elongate, subtriangular in outline, with lateral margin staight to distinctly constricted, bluntly pointed to acute apically; urogomphus 2-segmented, without subbasal suture, about 1.13–8.10x as long as LLAS; urogomphomere 1 subequal to distinctly longer than urogomphomere 2; urogomphus with only primary setae; setae UR2, UR3, and UR4 variously positioned, on urogomphomere 1; seta UR8 variously positioned on urogomphomere 2 (Fig. 198).

Instar II. As instar I except for the following characters:
Head. Head length = 0.41 – 0.98 mm; head width = 0.31 – 0.83 mm; head length: head width = 1.05 – 1.48; **head capsule**: occipital suture present; parietals usually with a variable number of lateral temporal spines; egg bursters absent; head appendages slightly shorter than in first-instar; **mandible:** toothed or not on inner margin.

Thorax. Legs: with natatory setae absent or present, where present natatory setae located in a single row on posterodorsal margin of tibia and tarsus or of femur, tibia and tarsus [except larvae of *Pachydrus* characterized by the presence of an anteroventral row of natatory setae on the femora (Alarie *et al.* 1997)].

Abdomen. LLAS = 0.25 – 0.76 mm; urogomphus length = 0.41 – 2.15 mm; siphon relatively shorter than in instar I; abdomen segments 3 to 6 either membranous or with a ventral plate well-delimited from the reminder sclerite; segment 7 ventrally completely sclerotized; urogomphus about 0.60 to 8.30x LLAS; urogomphomere 1 longer than urogomphomere 2, with secondary setae present or absent.

Instar III. As for instar II except for the following characters:
Head. Head length = 0.41 – 1.45 mm; head width = 0.31 – 1.19 mm; head length: head width = 1.06 – 1.80; **labium**, LB2 various, from shorter to longer than LB1.
Thorax. Mesothorax with a pair of spiracles on pleural region present or absent.

Abdomen. LLAS = 0.29 – 1.19 mm; urogomphus L = 0.28 – 3.78 mm; abdomen segments 1 to 7 with a pair of spiracles on pleural region present or absent; segments 2 to 6 either membranous ventrally or with a sclerotized plate; urogomphus about 0.25 to 7.20x LLAS.

Remarks. The larvae of *Anodocheilus*, *Bidessonotus*, *Brachyvatus*, *Comaldessus*, *Lioporus*, *Neobidessus*, and *Stygoporus* are unknown or undescribed and, accordingly, they are not included in the following keys. Similarly, the genera *Celina*, *Hydrovatus*, *Neoclypeodytes*, *Pachydrus*, *Haideoporus*, and *Sanfilippodytes* are excluded from the key to instar I because they are known as mature larva only.

Key to known genera of Hydroporinae of North America
Key to Instar I

1. Maxillary cardo absent (Fig. 196G) 2

1'. Maxillary cardo present (Fig. 196F) 5

2(1). Occipital suture present (Fig. 207A, C) ; larger species, head length greater than 0.40 mm 3

2'. Occipital suture absent (Fig. 209A); smaller species, head length less than 0.40 mm 4

3(2). Prementum lacking lateral spinulae; head length: head width less than 1.10 . . . .*Oreodytes* Seidlitz, p. 875

3'. Prementum with lateral spinulae (Fig. 196C); head length: head width greater than 1.20 . . .*Nebrioporus* Guignot and *Stictotarsus* Zimmermann

4(2). Labial palpomere 2 club-shaped (Fig. 209B); antennomere 2 without lateral pore; primary seta UR8 inserted proximally on urogomphomere 2 (Fig. 198I); length of urogomphus 2.30 – 2.80 times length of abdomen segment 8 (LLAS); lateral margin of abdomen segment 8 not constricted posterior to insertion of urogomphus . . . . *Desmopachria* Babington

4'. Labial palpomere 2 subcylindrical; antennomere 2 with a lateral pore; primary sate UR8 inserted subapically on urogomphomere 2; length of urogomphus more than 5 times length of abdomen segment 8 (LLAS); lateral margin of abdomen segment 8 constricted posterior to insertion of urogomphus . . . .*Liodessus* Guignot

5(1). Urogomphus subequal in length to abdomen segment 8 (LLAS) (Fig. 199B); urogomphus with basal articulations of primary setae UR2, UR3, and UR4 contiguous (Fig. 199B); primary seta UR8 inserted terminally on urogomphomere 2 (Fig. 198A); lateral margin of abdomen segment 8 not constricted posterior to insertion of urogomphus (Fig. 199B) . . . . *Laccornis* Gozis, p. 857

5'. Length of urogomphus more than 3 times length of abdomen segment 8 (LLAS); urogomphus with basal articulation of primary seta UR4 positioned more distally than those of setae UR2 and UR3 (Fig.198B – H); primary seta UR8 inserted subapically on urogomphomere 2 (Fig. 198B – H); lateral margin of abdomen segment 8 constricted posterior to insertion of urogomphus (Fig. 200F) 6

6(5). Antennomere 3 without an anteroventral spinula and without a lateral pore; seta UR8 inserted medially on urogomphomere 2 (Fig. 198G, H) . . . . *Hygrotus* Stephens, p. 870

6'. Antennomere 3 with an anteroventral spinula and with a lateral pore (Fig. 196A, B); seta UR8 inserted subapically on urogomphomere 2 (Fig. 198B – F) 7

7(6). Stemmata absent (Fig. 202A) . . *Hydrocolus* Roughley and Larson, p. 864

7'. Stemmata present 8

8(7). Length of urogomphus less than 5 times length of abdomen segment 8 (LLAS) (Fig. 200F) . . . . *Hydroporus* Clairville, p. 860

8'. Length of urogomphus more than 5 times length of abdomen segment 8 (LLAS) (Figs. 203B; 204B) 9

9(8). Urogomphus with basal articulations of primary setae UR2, UR3, and UR4 about subequally distant (Fig. 203B) . . . . *Neoporus* Guignot, p. 866

9'. Urogomphus with basal articulations of primary setae UR2 and UR3 contiguous, and with seta UR4 more distally positioned (Fig. 204B) . . . . *Heterosternuta* Strand, p. 868

Key to instar II and III

1. Ocularium absent; cavernicolous, known only from artesian wells in Texas . . . .*Haideoporus* Young & Longley [not treated further]

1'. Ocularium present, if absent, not normally confined to artesian waters; surface dwelling 2

2(1). Abdomen segment 8 with a recurved extension of the lateral tracheal trunk at apex of siphon (Fig. 211B) . . . . *Celina* Aubé, p. 884

2'. Abdomen segment 8 without a recurved extension of the lateral tracheal trunk at apex of siphon 3

3(2). Abdomen segment 6 sclerotized ventrally; lateral margin of segment 8 not constricted at level of point of insertion of urogomphus (Fig. 209F) 4

3'. Abdomen segment 6 membranous ventrally; lateral margin of segment 8 constricted or not at level of point of insertion of urogomphus 6

4(3). Urogomphus distinctly shorter than abdomen segment 8 (Fig. 210A, B) 5

4'. Urogomphus distinctly longer than abdomen segment 8 (Fig. 209F) . . . . *Desmopachria* Babington, p. 880

5(4). Frontoclypeus narrow, with a short lateral branch on each side (Fig. 210C); femora with natatory setae along anteroventral margin (Fig. 210E) . . . .*Pachydrus* Sharp, p. 882

5'. Frontoclypeus broader, lacking lateral branch on each side (Fig. 225B); femora lacking natatory setae . . . . *Hydrovatus* Motschulsky, p. 879

6(3). Antennomere 2 with one dorsomedian seta (Fig. 202C); ocularium absent (instar II) or present (instar III), if present, stemma fairly small, subequal in width to maximum width of antennomere 1 (Fig. 202C) .... *Hydrocolus* Roughley and Larson, p. 864

6'. Antennomere 2 without seta; ocularium present, stemma larger, at least 2 times width of antennomere 1 7

7(6). Urogomphus with basal articulations of primary setae UR2, UR3, and UR4 contiguous (Fig. 199B, E); lateral margin of abdomen segment 8 not constricted at level of point of insertion of urogomphus (Fig. 199E); urogomphus distinctly shorter than abdomen segment 8 (Fig. 199E) .... *Laccornis* Gozis, p. 857

7'. Urogomphus with basal articulation of primary seta UR4 not contiguous to setae UR2 and UR3 (Fig. 200G); lateral margin of abdomen segment 8 constricted at level of point of insertion of urogomphus (Fig. 200G); urogomphus distinctly longer than abdomen segment 8 (Fig. 200G) 8

8(7). Urogomphus with secondary setae (Fig. 203E, 204D) 9

8'. Urogomphus without secondary setae (Figs. 200G; 201D) 14

9(8). Antennomere 3 with an anteroventral spinula present and a lateral pore present or absent (Fig. 196A, B) 10

9'. Antennomere 3 with both anteroventral spinula and lateral pore absent .... *Hygrotus* Stephens, in part, p. 870

10(9). Maxillary cardo absent (Fig. 196G); antennomere 3 with lateral pore absent 11

10'. Maxillary cardo present (Fig. 196F); antennomere 3 with lateral pore present (Fig. 196A) 13

11(10). Legs with natatory setae absent (Fig. 208A, B); head capsule distinctlyconstricted at level of occipital suture (Fig. 207D – G) .... *Oreodytes* Seidlitz, p. 875

11'. Legs with natatory setae present (Fig. 206B, D); head capsule at most slightly constricted at level of occipital suture 12

12(11). Head capsule less than 1.30 times as long as broad .... *Nebrioporus* Régimbart, p. 874

12'. Head capsule more than 1.40 times as long as broad .... *Stictotarsus* Zimmermann, p. 873

13(10). Legs with natatory setae present (Fig. 203G) .... *Neoporus* Guignot, in part, p. 866

13'. Legs with natatory setae absent (Fig. 204E, F) . . . . *Heterosternuta* Strand, p. 868

14(8). Legs with natatory setae present (Fig. 203G) 15

14'. Legs with natatory setae absent (Fig. 204E, F) 16

15(14). Antennomere 3 with an anteroventral spinula and a lateral pore present (Fig. 196A, B) . . . . *Neoporus* Guignot, in part, p. 866

15'. Antennomere 3 with both anteroventral and lateral pore absent . . . .*Hygrotus* Stephens, in part, p. 870

16(14). Urogomphus with basal articulations of primary setae UR2, UR3, and UR4 about subequally distant (Fig. 198F); smaller species 17

16'. Urogomphus with basal articulations of primary setae UR2 and UR3 contiguous and with seta UR4 inserted more distally (Figs. 200G; 201D); larger species 19

17(16). Urogomphus more than 3 times as long as abdomen segment 8 . . . . *Liodessus* Guignot, p. 885

17'. Urogomphus less than 2 times as long as abdomen segment 8 18

18(17). Labial palpomere 2 distinctly shorter than labial palpomere 1 (instar III) . . . . *Uvarus* Guignot, p. 887

18'. Labial palpomere 2 subequal to longer than labial palpomere 1 (instar III) . . . .*Neoclypeodytes* Young, p. 887

19(16). Urogomphus less than 2.4 times as long as abdomen segment 8 (instar III) . . . .*Hydroporus* Clairville, p. 860

19'. Urogomphus more than 2.6 times as long as abdomen segment 8 (instar III) . . . . *Sanfilippodytes* Franciscolo, p. 862

Genus *Laccornis* Des Gozis
Figs. 198A; 199; 229B

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs without natatory setae; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 not constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus subequal to or distinctly shorter than abdomen segment 8; urogomphomere 1 without secondary setae; basal articulations of primary setae UR2, UR3, and UR4 contiguous.

Instar I (Fig. 198A, 199A, B).
Head. Head length = 0.61 – 0.63 mm; head width = 0.46 – 0.50 mm; head length: head width = 1.30; **head capsule** (Fig. 199A): broadly ovate in dorsal view, widest just

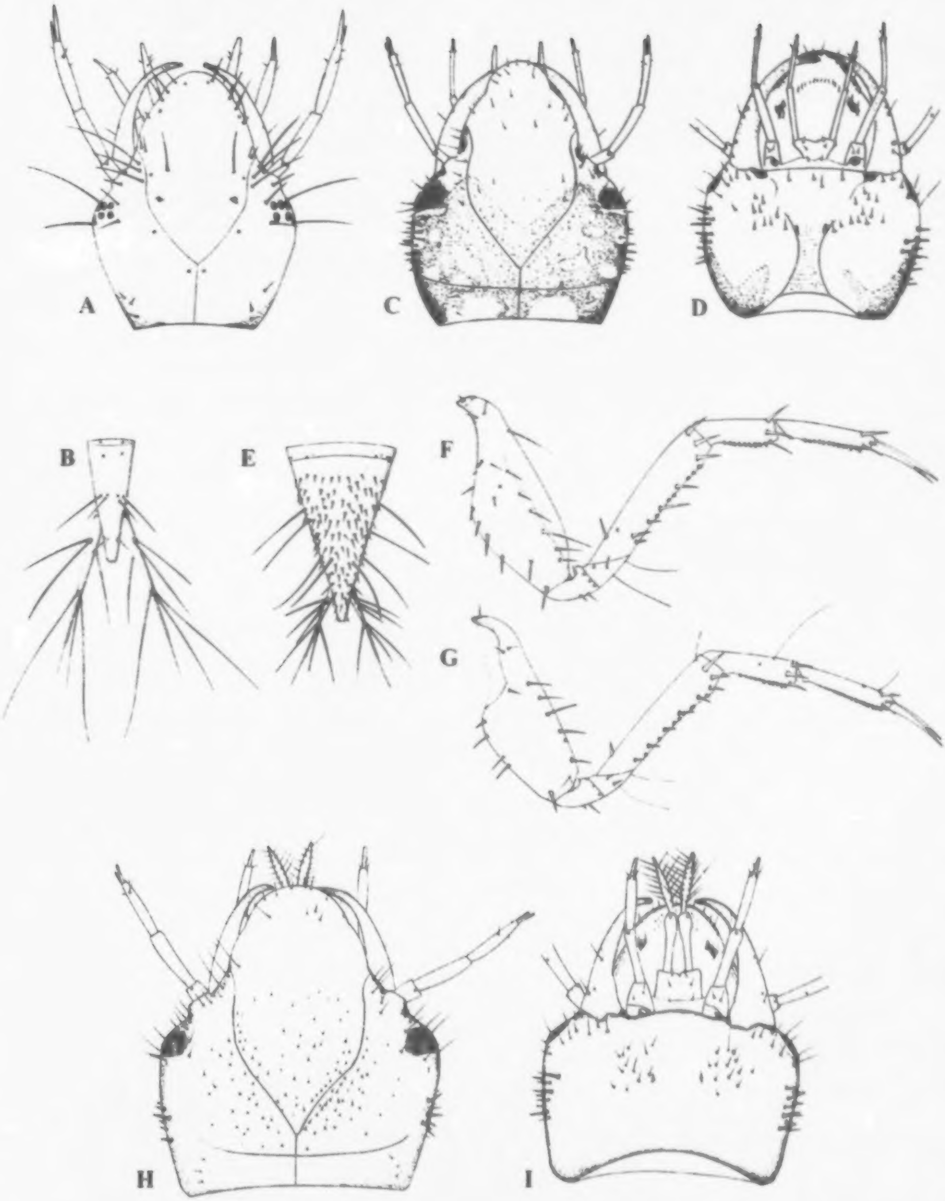

Fig. 199. Hydroporinae, *Laccornis*. A – G - *Laccornis latens*, A, B - instar I. A - head capsule, dorsal. B - last abdominal segment with urogomphi, dorsal. C – G - Instar III. C - head capsule, dorsal. D - head capsule, ventral. E - last abdominal segment, dorsal. F, G - metathoracic leg, F - anterior, G - posterior. H, I - *L. oblongus*, head capsule instar III, H - dorsal, I - ventral. Drawn to different scales.

posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e. lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus without lateral notches but slightly undulating laterally; ocularium present; **mandible** not serrate; **maxilla** with cardo reduced, ovate; **labium** with prementum varying from trapezoidal to quadrate; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Abdomen (Figs. 198A; 199B). LLAS = 0.38-0.43 mm; urogomphus L = 0.46 – 0.48 mm; segment 8 slender, subconical, lateral margin straight, strongly and evenly converging from base to apex of siphon; siphon elongate, bluntly pointed; urogomphus about 1.10x LLAS; urogomphomere 1 distinctly longer than urogomphomere 2; basal articulations of primary setae UR2, UR3, and UR4 contiguous; seta UR8 terminal in position on urogomphomere 2 (Fig. 198A).

Instar II. As instar I except for the following characters:
Head. Head length = 0.92 – 0.95 mm; head width = 0.68 – 0.72 mm; head length: head width = 1.33; **head capsule** rounded to subtrapezoidal in dorsal view.

Thorax. Legs without natatory setae (Fig. 197F – G).

Abdomen. LLAS = 0.68 – 0.76 mm; urogomphus L = 0.41 mm; segments 3 to 6 membranous ventrally; urogomphus about 0.60x LLAS, with secondary setae absent.

Instar III (Figs. 199C – I; 229B). As for instar II except for the following characters:
Head (Fig. 199C, D, H, I). Head length = 0.91 – 1.33 mm; head width = 0.79 – 1.10 mm; head length: head width = 1.18; **labium**, LB2 subequal to LB1 in length.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.88–1.18 mm; urogomphus L = 0.37–0.54 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 0.40-0.50x LLAS.

Comments. Except for *Celina* and *Pachydrus*, larvae of *Laccornis* differ from other Hydroporinae by the relative elongation of the urogomphus which is, at most, subequal (in instar I) to length of abdomen segment 8. *Celina* differs from *Laccornis* by the presence of an extended tracheal trunk at the apex of the siphon. Larvae of *Pachydrus* are distinguished by features such as the narrow, branched and elongate frontoclypeus, presence of several natatory setae on the anteroventral margin of femora, and the fully sclerotized abdomen segment 6. In North America, the larvae of four species of *Laccornis* have been described: *L. conoideus* (Watts 1970; Alarie 1989), *L. latens* (Alarie 1989), *L. oblongus* (Cuppen and Dettner 1987; Alarie 1989), and *L. etnieri* (Spangler and Gordon 1973, as *L. difformis*).

Genus *Hydroporus* Clairville

Figs. 197B, D; 198C; 200; 227B

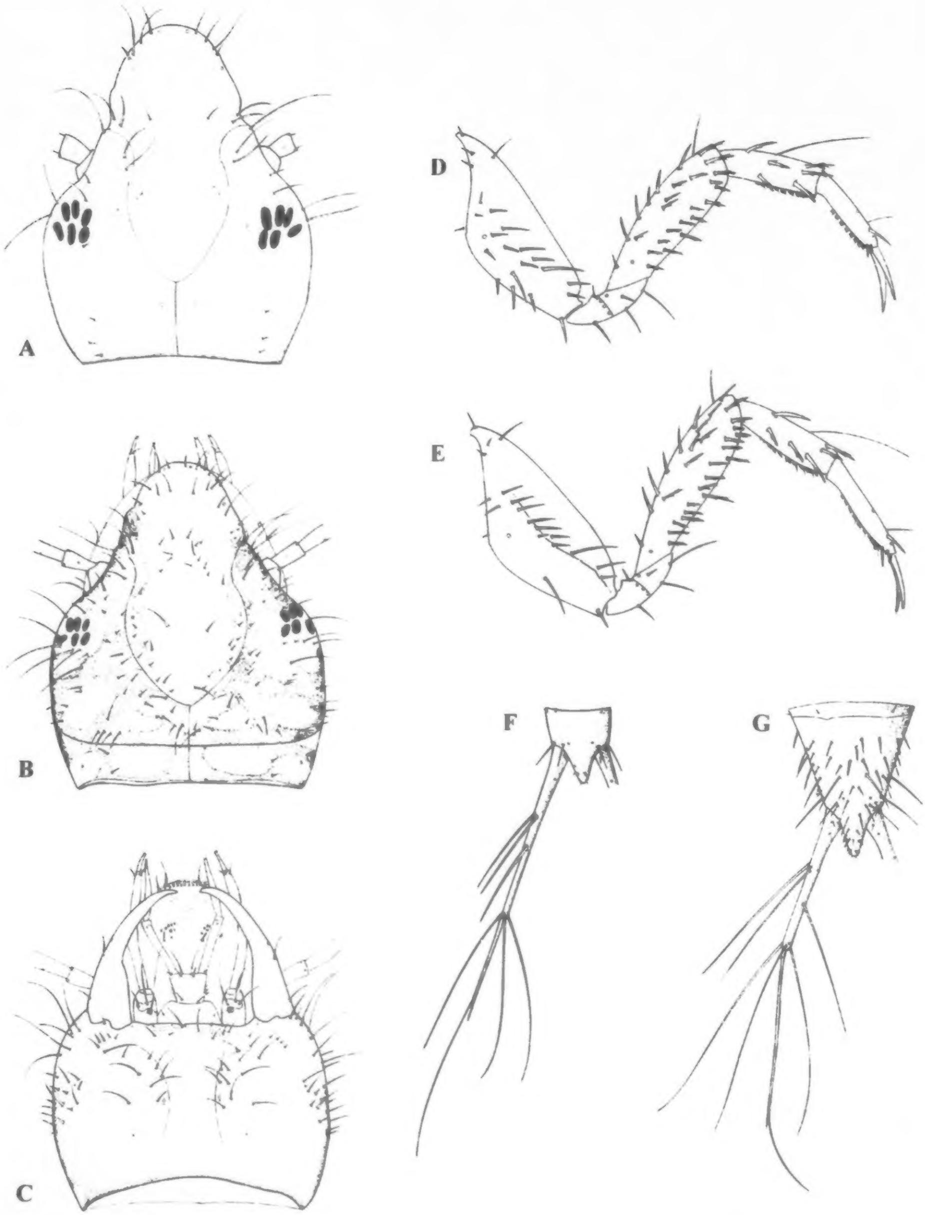

Fig. 200. Hydroporinae, *Hydroporus*. A – C - *H. dentellus* head capsule, A - instar I, dorsal, B - instar III, dorsal, C - instar III, ventral. D, E - metathoracic leg instar III, anterior surface, D - *H. obscurus*, E - *H. signatus*. F, G - last abdominal segment, dorsal, F - *H. tenebrosus* instar I, G - *H. puberulus* instar III. Drawn to different scales.

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs without natatory setae; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 without secondary setae; urogomphus with basal articulations of primary setae UR2 and UR3 contiguous, and with seta UR4 positioned more distally.

Instar I (Figs. 197B, D; 198C; 200A, F).
Head (Fig. 200A). Head length = 0.41 – 0.64 mm; head width = 0.34 – 0.56 mm; head length: head width = 1.13 – 1.29; **head capsule** broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus with lateral notches present; ocularium present; **mandible** not serrate; **maxilla** with cardo reduced and ovate; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Abdomen (Figs. 198C; 200F). LLAS = 0.17–0.25 mm; urogomphus L = 0.79–1.03 mm; segment 8 slender, more or less elongate, and feebly conical, lateral margin straight to slightly concave, subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately elongate, subtriangular in outline, with lateral margin more-or-less constricted, bluntly pointed apically; urogomphus about 3.59–4.72x LLAS; urogomphomere 1 longer than urogomphomere 2; basal articulations of primary setae UR2 and UR3 contiguous, and seta UR4 is inserted more distally on urogomphomere 1 (Figs. 198C, 200F); seta UR8 subterminal in position, articulated distally on urogomphomere 2 (Figs. 198C, 200F).

Instar II. As instar I except for the following characters:
Head. Head length = 0.64 – 0.96 mm; head width = 0.53 – 0.83 mm; head length: head width = 1.14 – 1.28; **mandibles** toothed or not on inner margin.

Thorax. Legs with natatory setae absent (Fig. 200D, E).

Abdomen. LLAS = 0.29 – 0.50 mm; urogomphus L = 0.99 – 1.40 mm; segments 3 to 6 membranous ventrally; urogomphus about 2.33–3.55x LLAS; urogomphomere 1 with secondary setae absent (Fig. 200G).

Instar III (Figs. 200B–E, G; 227B). As for instar II except for the following characters:
Head (Fig. 200B, C). Head length = 0.70 – 1.35 mm; head width = 0.60 – 1.19 mm; head length: head width = 1.06 – 1.27; **labium**, LB2 various, from shorter to longer than LB1.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen (Fig. 200G). LLAS = 0.44–0.86 mm; urogomphus L = 0.79–1.40 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 1.49–2.39x LLAS.

Comments. The genus *Hydroporus* contains a large number of morphologically similar species. Within Hydroporinae, it is likely that larvae of *Hydroporus* might be confounded with those of both *Sanfilippodytes* and *Hygrotus* (those species lacking natatory setae on legs and secondary setae on urogomphus). Recent studies on larval chaetotaxy and porotaxy of North American Hydroporinae (Alarie 1991*a*, 1991*b*, 1992, 1995; Alarie and Harper 1990; Alarie *et al.* 1990*a*; Alarie *et al.* 1990*b)* have provided many useful characters for distinguishing larvae of *Hydroporus* from those of *Hygrotus*, including the presence on antennomere 3 of an anteroventral spinula and a lateral pore (Fig. 196A, B), and the position of the primary seta UR8 which is consistently inserted subapically on urogomphomere 2 (more evident in instar I) (Figs. 198C; 200F). It is more difficult to separate larvae of *Hydroporus* from those of *Sanfilippodytes*. The larva of only one species of *Sanfilippodytes* has been described until now (Alarie 1991*a)* and, based on this description, *Sanfilippodytes* is distinguished by slightly longer urogomphi when compared with the length of abdomen segment 8.

In North America, the larvae of *H. badiellus*, *H. columbianus*, *H. dentellus*, *H. fuscipennis*, *H. lapponum*, *H. morio*, *H. nigellus*, *H. niger*, *H. notabilis*, *H. obscurus*, *H. puberulus*, *H. signatus*, *H. striola*, *H. tenebrosus*, and *H. tristis* have been described (Meinert 1901; Wilson 1923; Bertrand 1928; Watts 1970; Barman 1972; Jeppesen 1986; Nilsson 1986, 1987*b*, 1989; Nilsson and Carr 1989; Alarie 1991*a*, 1995*a*).

Genus *Sanfilippodytes* Francisco lo
Fig. 201, 228A

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs without natatory setae; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 without secondary setae; basal articulations of primary setae UR2 and UR3 contiguous, and seta UR4 articulated more distally on urogomphomere 1.

Instars I and II. Unknown

Instar III (Figs. 201; 228A).
Head (Fig. 201A). Head length =0.86 – 0.87 mm; head width = 0.67 – 0.70 mm; head length: head width = 1.27; **head capsule** broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e. lateral margin not constricted posteriorly); frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo reduced and ovate; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 slightly longer than LB1.

Thorax. Legs (Fig. 201B, C) without natatory setae; mesothorax with a pair of spiracles on pleural region.

Abdomen (Fig. 201D). LLAS = 0.47 mm; urogomphus L = 1.22 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; segment 8 slender, more or less elongate, and feebly conical, lateral margin straight to slightly concave, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately elongate, subtriangular in outline, with lateral margin strongly constricted, bluntly pointed apically; urogomphus about

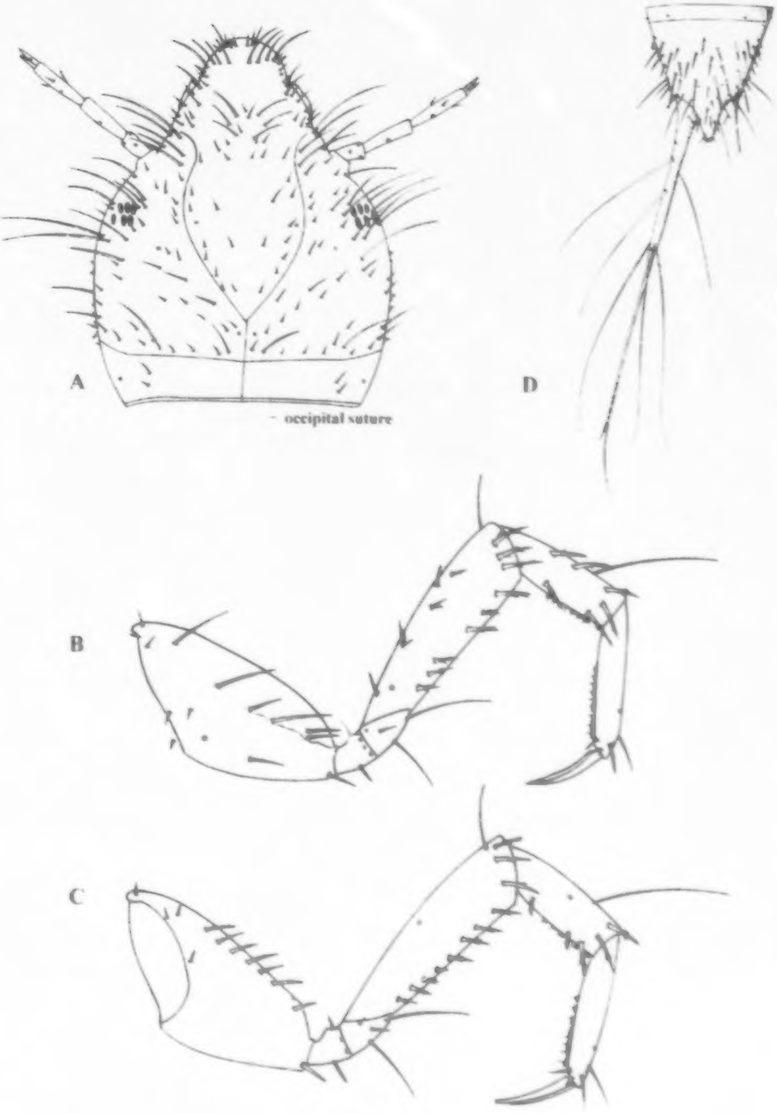

Fig. 201. Hydroporinae, *Sanfilippodytes planiusculus* instar III. A - head capsule, dorsal. B, C - metathoracic leg, B - anterior, C - posterior. D - last abdominal segment, dorsal. Drawn to different scales.

2.62x LLAS; urogomphomere 1 slightly shorter than urogomphomere 2; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 inserted more distally on urogomphomere 1; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Comments. *Sanfilippodytes planiusculus* (Fall) is the only species of *Sanflippodytes* known as a larva (mature) (Alarie 1991*a*). This species is quite similar to those of the genus *Hydroporus* (s. str.) (see also under *Hydroporus*).

Genus *Hydrocolus* Roughley and Larson
Figs. 197A; 198D; 202; 229A

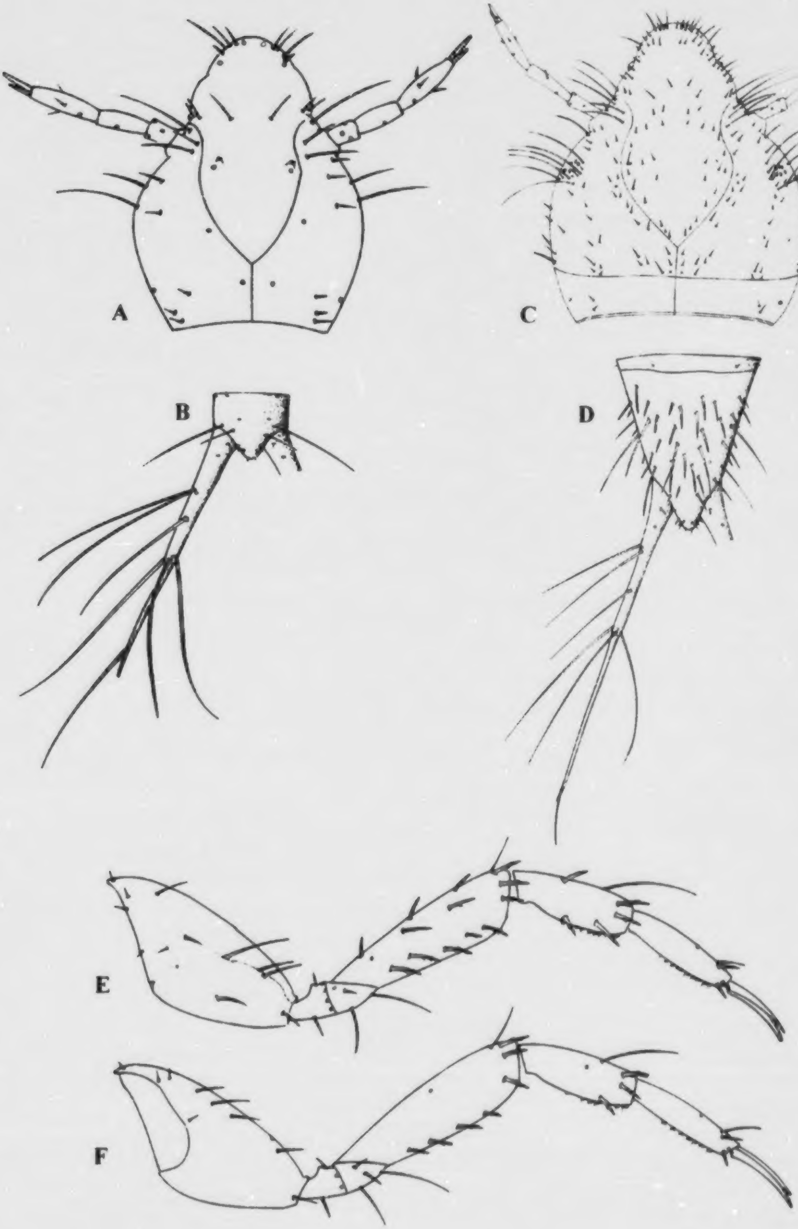

Fig. 202. Hydroporinae, *Hydrocolus paugus*. A, B - instar I. A - head capsule dorsal. B - last abdominal segment dorsal. C – F - instar III. C - head capsule, dorsal. D - last abdominal segment, dorsal. E, F - metathoracic leg, E - anterior, F - posterior. Drawn to different scales.

Diagnosis. Ocularium absent (instar I and II) or present (instar III); maxillary cardo present; prementum subrectangular; labial palpomere 2 subcylindrical; antennomere 2 with a secondary seta in instar II and III larvae; legs without natatory setae; spiracular openings present in instar III larva; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 without secondary setae; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 articulated more distally on urogomphomere 1.

Instar I (Figs. 197A; 198D; 202A, B).
Head. Head length = 0.44 mm; head width = 0.35 mm; head length: head width = 1.27; **head capsule** (Fig. 202A): broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e. lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus with lateral notches; ocularium absent; **mandible** not serrate; **maxilla** with cardo reduced and ovate; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Thorax. Legs (Fig. 197A) without natatory setae.

Abdomen (Figs. 198C; 202). LLAS = 0.17 mm; urogomphus L = 0.62 mm; segment 8 slender, more or less elongate, and feebly conical, lateral margin straight to slightly concave, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately elongate, subtriangular in outline, with lateral margin slightly constricted, bluntly pointed apically; urogomphus about 3.60x LLAS; urogomphomere 1 slightly longer than urogomphomere 2; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 inserted more distally on urogomphomere I; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Instar II. Unknown. The analysis of the exuviae of instar II larva by Alarie (1991*a)* reveals that ocularium are absent in instar II.

Instar III (Figs. 202C–F; 229A). As for instar I except for the following characters:
Head. Head length = 0.97 mm; head width = 0.84 mm; head length: head width = 1.15; **head capsule** (Fig. 202C): ocularium present, stemma of very small size; **labium:** LB2 subequal to LB1 in length.

Thorax. Mesothorax with a pair of spiracles on pleural region; **legs** (Fig. 202E, F) with natatory setae absent.

Abdomen (Fig. 202D). LLAS = 0.52 mm; urogomphus L = 1.01 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 1.94x LLAS.

Comments. In North America, *Hydrocolus paugus* (Fall) is the only species of the genus for which the larvae have been described (Alarie 1991*a)*. Larvae of this species are characterized by the absence of an ocularium in instar I and II, and by the presence of a secondary seta on antennomere 2, in instar II and III.

Genus *Neoporus* Guignot

Figs. 197E; 198E; 203; 226B

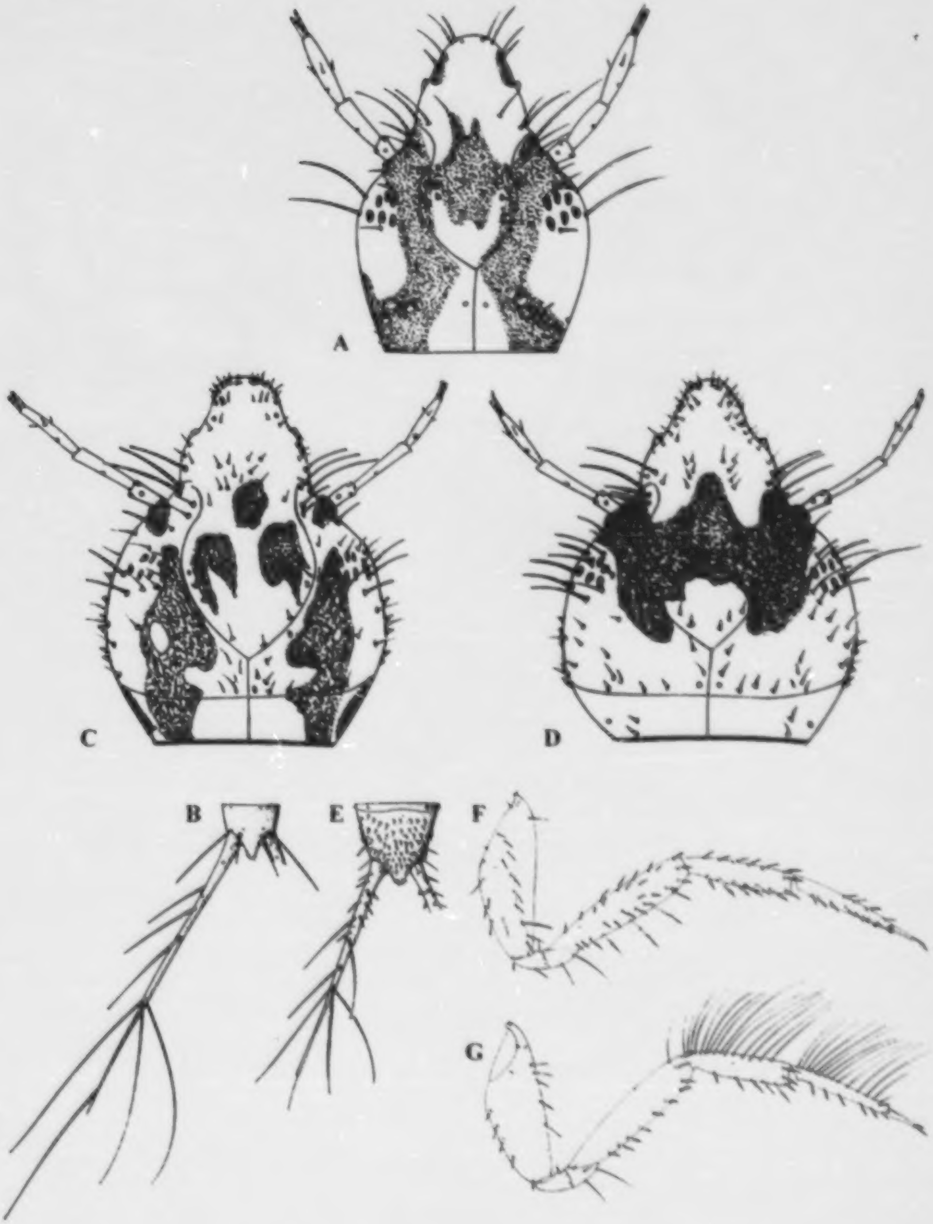

Fig. 203. Hydroporinae, *Neoporus*. A, B - *Neoporus undulatus* instar I. A - head capsule, dorsal. B - last abdominal segment, dorsal. C – G - instar III. C - *N. undulatus* head capsule, dorsal. D - *N. carolinus* head capsule, dorsal. E – G - *N. undulatus*. E - last abdominal segment, dorsal. F, G - metathoracic leg, F - anterior, G - posterior. Drawn to different scales.

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae present in instar II and III; spiracular openings absent in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae absent or present (in instar II and III); basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1.

Instar I (Figs. 197E; 198E; 203B).
Head. Head length = 0.51 – 0.54 mm; head width = 0.36 – 0.41 mm; head length: head width = 1.31; **head capsule** (Fig. 203A) broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e. lateral margin not constricted posteriorly); frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo reduced and ovate; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Thorax. Legs (Fig. 197E) without natatory setae.

Abdomen (Figs. 198E; 203B). LLAS = 0.18–0.19 mm; urogomphus L = 0.93–1.05 mm; segment 8 slender, more or less elongate, and feebly conical, lateral margin straight to slightly concave, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately elongate, subtriangular in outline, with lateral margin more-or-less constricted, bluntly pointed apically; urogomphus about 5.45x LLAS; urogomphomere 1 longer than urogomphomere 2; basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Instar II. As instar I except for the following characters:
Head. Head length = 0.79 – 0.84 mm; head width = 0.61 – 0.65 mm; head length: head width = 1.32.

Thorax. Legs with natatory setae present (Fig. 203G).

Abdomen. LLAS = 0.34–0.36 mm; urogomphus L = 1.39–1.48 mm; segment 3 to 6 membranous ventrally; urogomphus about 4.10x LLAS; urogomphomere 1 with secondary setae absent or present.

Instar III (Figs. 203C – G; 226B). As for instar II except for the following characters:
Head (Fig. 203C, D). Head length = 1.16 – 1.25 mm; head width = 0.88 – 1.02 mm; head length: head width = 1.22–1.30; **labium**, LB2 slightly shorter than LB1.

Thorax. Mesothorax lacking spiracles on pleural region.

Abdomen (Fig. 203E). LLAS = 0.50–0.64 mm; urogomphus L = 1.58–1.80 mm; segments 1 to 7 lacking spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 2.72–3.21x LLAS.

Comments. Larvae of *Neoporus* and *Heterosternuta* are very distinctive within Hydroporinae because of absence of spiracular openings in mature larvae. *Neoporus* differs from *Heterosternuta* by the about equidistant position of the primary setae UR2, UR3, and UR4, in instar I, and by the presence of natatory setae on legs, in instar II and III. The larvae of *N. blanchardi*, *N. carolinus*, *N. cimicoides*, *N. clypealis*, *N. lobatus*, *N. shermani*, *N. solitarius*, *N. superioris*, and *N. undulatus* have been described (Needham and Williamson 1907; Barman 1972; Matta and Peterson 1985; Alarie 1991*a*).

Genus *Heterosternuta* Strand
Figs. 197C; 204; 226A

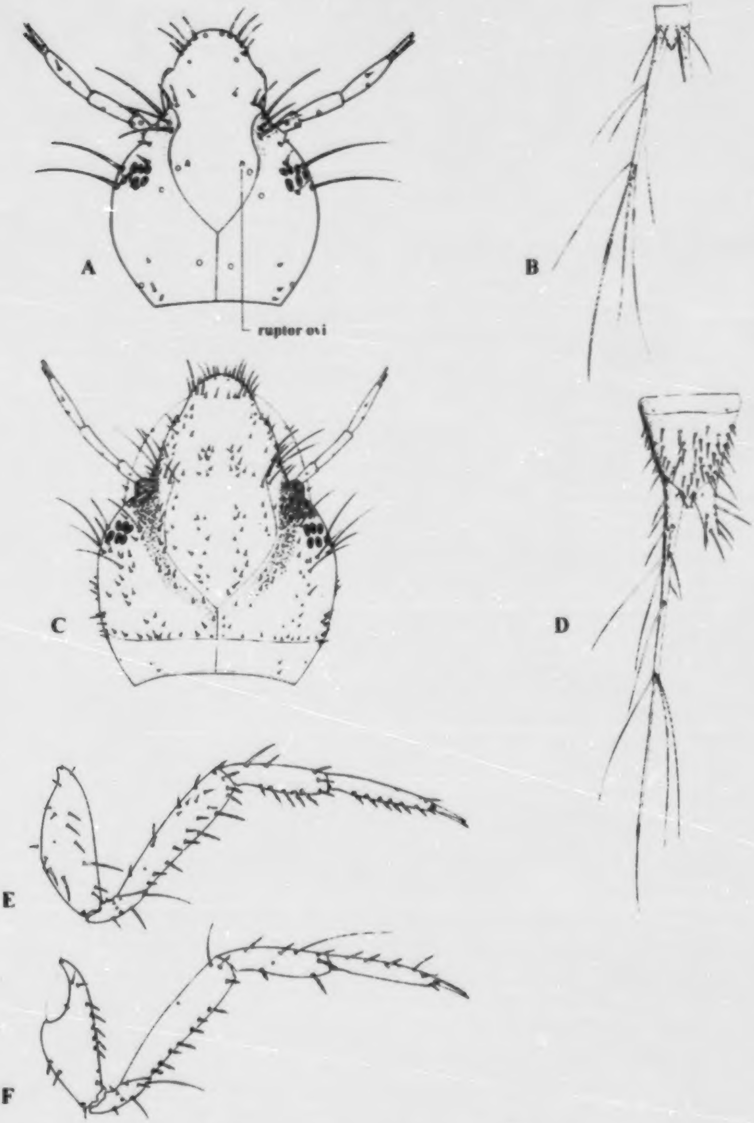

Fig. 204. Hydroporinae, *Heterosternuta cocheconis*. A, B - instar I. A - head capsule, dorsal. B - last abdominal segment, dorsal. C – F - instar III. C - head capsule, dorsal. D - last abdominal segment, dorsal. E, F - metathoracic leg, E - anterior, F - posterior. Drawn to different scales.

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs withtout natatory setae; spiracular openings absent in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae present in instar II and III; basal articulations of primary setae UR2, and UR3 contiguous, seta UR4 postioned more distally on urogomphomere 1.

Instar I (Figs. 197C; 204A, B).
Head. Head length = 0.44 – 0.55 mm; head width = 0.38 – 0.41 mm; head length: head width = 1.20–1.33; **head capsule** (Fig. 204A): broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e. lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo reduced and ovate; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.
Thorax. Legs (Fig. 197C) without natatory setae.

Abdomen (Fig. 204B). LLAS = 0.13–0.15 mm; urogomphus L = 0.84–0.89 mm; segment 8 slender, more or less elongate, and feebly conical, lateral margin straight to slightly concave, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately elongate, subtriangular in outline, with lateral margin more-or-less constricted, bluntly pointed apically; urogomphus about 5.80–6.70x LLAS; urogomphomere 1 shorter than urogomphomere 2; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 inserted more distally on urogomphomere 1; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Instar II. As instar I except for the following characters:
Head. Head length = 0.75 – 0.78 mm; head width = 0.59 – 0.61 mm; head length: head width = 1.27.

Thorax, legs with natatory setae absent (Fig. 204E, F).
Abdomen. LLAS = 0.16–0.18 mm; urogomphus L = 1.14–1.18 mm; segment 3 to 6 membranous ventrally; urogomphus about 4.87x LLAS; urogomphomere 1 with secondary setae.

Instar III (Figs. 204C–F; 226A). As for instar II except for the following characters:
Head (Fig. 204C). Head length = 0.89 – 1.08 mm; head width = 0.76 – 0.87 mm; head length: head width = 1.18–1.22; **labium**, LB2 slightly shorter than LB1.

Thorax. Mesothorax lacking spiracles on pleural region.

Abdomen (Fig. 204D). LLAS = 0.39–0.40 mm; urogomphus L = 1.29–1.38 mm; segments 1 to 7 lacking spiracles on pleural region; urogomphus about 3.39–3.44x LLAS.

Comments. See under *Neoporus*. The larvae of *H. cocheconis*, *H. diversicornis*, and *H. wickhami* have been described (Alarie 1991*a*, 1992; Alarie and Fritz 1998).

Genus *Hygrotus* Stephens
Figs. 198H; 205; 206; 227A

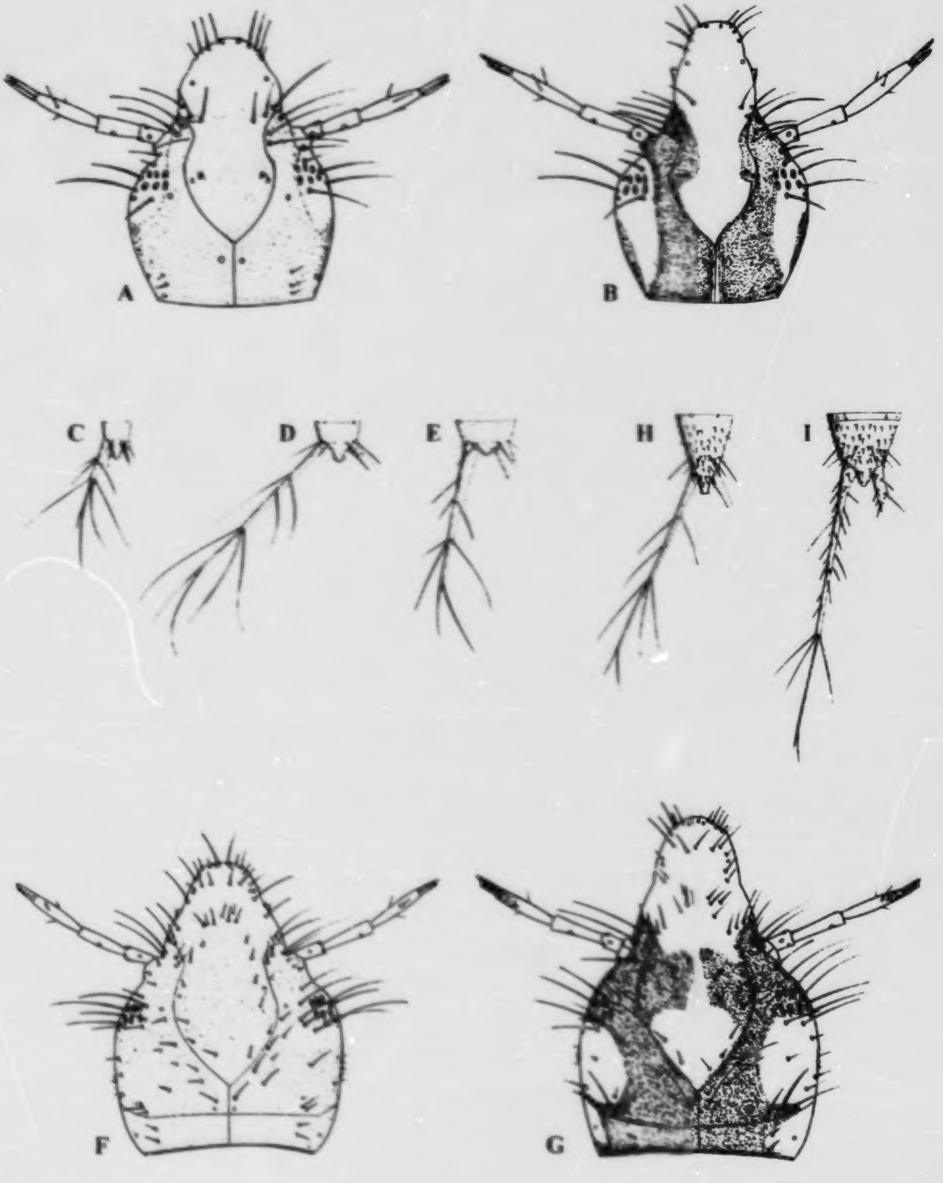

Fig. 205. Hydroporinae, *Hygrotus* Stephens. A – E - instar I. A - *H. laccophilinus* head capsule, dorsal. B - *H. sayi* head capsule, dorsal. C - *H. laccophilinus* last abdominal segment, dorsal. D - *H. picatus* last abdominal segment, dorsal. E - *H. masculinus* last abdominal segment, dorsal. F – I - instar III. F - *H. laccophilinus* head capsule, dorsal. G - *H. farctus* head capsule, dorsal. H - *H. novemlineatus* last abdominal segment, dorsal. I - *H. masculinus* last abdominal segment, dorsal. Drawn to different scales.

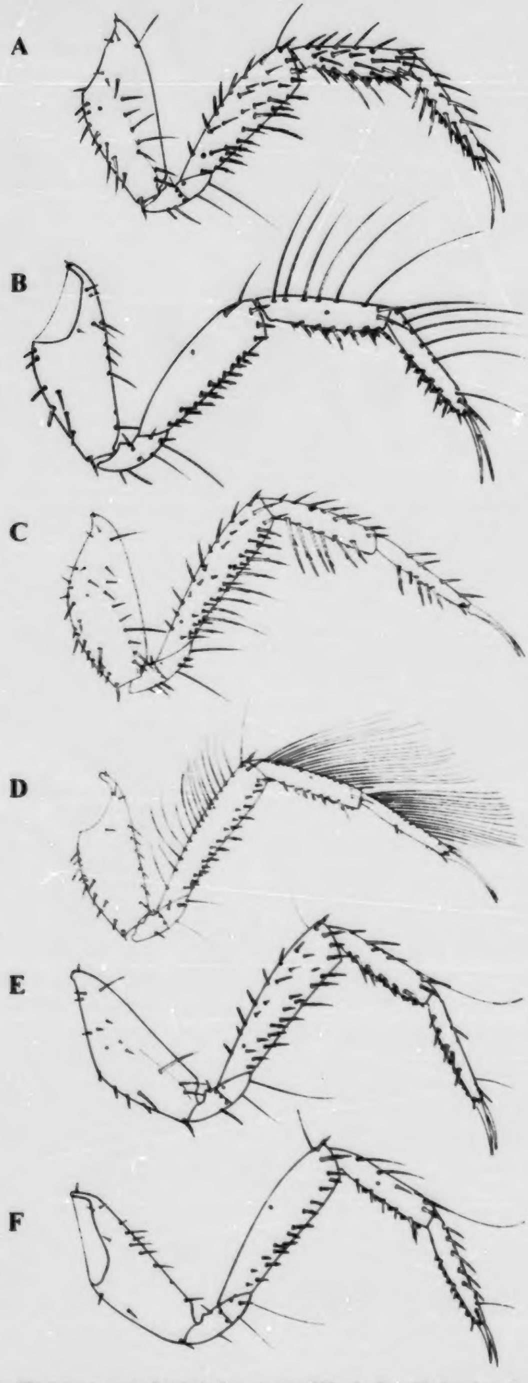

Fig. 206. Hydroporinae, *Hygrotus*, metathoracic leg, instar III. A, B - *H. farctus*, A - anterior, B - posterior. C, D - *H. masculinus*, C - anterior, D - posterior. E, F - *H. dissimilis*, E - anterior, F - posterior. Drawn to different scales.

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae absent or present (instar II and III); spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus subequal to or distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae present (instar II and III) or absent; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 articulated more distally on urogomphomere 1.

Instar I (Figs. 198H; 205A – E).
Head. Head length = 0.41 – 0.62 mm; head width = 0.31 – 0.46 mm; head length: head width = 1.27–1.46; **head capsule** (Fig. 205A, B): broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo reduced and ovate; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Thorax. Legs without natatory setae.

Abdomen (Figs. 205C – E). LLAS = 0.20 – 0.29 mm; urogomphus L = 0.51 – 1.50 mm; segment 8 slender, more or less elongate, and feebly conical, lateral margin straight to slightly concave, subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon elongate, subtriangular in outline, with lateral margin slightly constricted, bluntly pointed apically; urogomphus about 2.35–6.48x LLAS; urogomphomere 1 subequal to or longer than urogomphomere 2; basal articulations of primary setae UR2 and UR3 contiguously articulated, seta UR4 articulated more apically on urogomphomere 1; seta UR8 subterminal in position, articulated about middle of urogomphomere 2.

Instar II. As instar I except for the following characters:
Head. Head length = 0.57 – 0.98 mm; head width = 0.45 – 0.73 mm; head length: head width = 1.27 – 1.36.

Thorax. Legs with natatory setae absent (Fig. 206E, F) or present (Fig. 206A – D).

Abdomen. LLAS = 0.36 – 0.67 mm; urogomphus L = 0.54 – 1.90 mm; segments 3 to 6 membranous ventrally; urogomphus about 1.24 – 4.50x LLAS.

Instar III larva (Figs. 205F–I; 206; 227A). As for instar II except for the following characters:
Head (Fig. 205F, G). Head length = 0.70 – 1.40 mm; head width = 0.54 – 1.09 mm; head length: head width = 1.14 – 1.37; **labium**, LB2 subequal to LB1 in length.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen (Fig. 205H, I). LLAS = 0.53 – 1.19 mm; urogomphus L = 0.61 – 2.56 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 0.94 – 2.92x LLAS.

Comments. Larvae of the genus *Hygrotus* show a great range of structural diversity. They can be subdivided into two subsets based on absence (*H. laccophilinus*, *H. sayi*, *H. impressopunctatus*, *H. picatus*, *H. dissimilis*, *H. marklini*) or presence (*H. farctus*, *H. falli*, *H. patruelis*, *H. hudsonicus*, *H. nubilus*, *H. sellatus*, *H. tumidiventris*, *H. masculinus*) of natatory setae on legs. The latter group of species may be further subdivided into three subgroups:

a) with natatory setae on the tibiae and tarsi and lacking secondary setae on the urogomphi (*H. farctus*, *H. falli*, *H. patruelis*, *H. hudsonicus*, *H. nubilus*, *H. sellatus*);
b) natatory setae present on tibiae and tarsi and secondary setae present on urogomphi (*H. tumidiventris*, *H. punctilineatus*);
c) natatory setae present on femora, tibiae and tarsi and secondary setae on urogomphi (*H. masculinus*). (see also under *Hydroporus*).

In North America, the larvae of *H. dissimilis*, *H. falli*, *H. farctus*, *H. hudsonicus*, *H. impressopunctatus*, *H. laccophilinus*, *H. marklini* *H. masculinus*, *H. nubilus*, *H. patruelis*, *H. picatus*, *H. punctilineatus*, *H. sayi*, *H. sellatus*, and *H. tumidiventris* have been described (Watts 1970; Barman 1972; Spangler and Gillespie 1973; Alarie *et al.* 1990*b*).

Genus *Stictotarsus* Zimmermann

Figs. 198B; 230A

Diagnosis. Ocularium present; maxillary cardo absent; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae present in instar II and III; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae present; basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1.

Instar I (Fig. 198B).
Head. Head length = 0.74 mm; head width = 0.75 mm; head length: head width = 1.35; **head capsule** pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture present; frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo absent; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Thorax. Legs without natatory setae.

Abdomen (Fig. 198B). LLAS = 0.25 mm; urogomphus L = 1.73 mm; segment 8 slender, short, and subtrapezoidal, lateral margin subparallel, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon short, subtriangular in outline, with lateral margin slightly constricted, bluntly pointed apically; urogomphus about 7.00x LLAS; urogomphomere 1 longer than urogomphomere 2; basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Instar II. As instar I except for the following characters:
Head. Head length = 0.82 – 0.96 mm; head width = 0.61 – 0.66 mm; head length: head width = 1.42 – 1.48.

Thorax. Legs with natatory setae.

Abdomen. LLAS = not available; urogomphus L = not available; segments 3 to 6 membranous ventrally; urogomphus about 6.00x LLAS; urogomphomere 1 with secondary setae.

Instar III (Fig. 230A). As for instar II except for the following characters:
Head. Head length = 1.24 – 1.45 mm; head width = 0.88 – 0.95 mm; head length: head width = 1.43 – 1.53; **labium**, LB2 slightly longer than LB1

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Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.58 mm; urogomphus L = 3.78 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 tc 6 membranous ventrally; urogomphus about 6.40x LLAS.

Comments. Because of the presence of natatory setae on legs and secondary setae on the urogomphus, larvae of *Stictotarsus* are likely to be confounded with those of *Neoporus*, *Nebrioporus*, and some species of *Hygrotus*. *Stictotarsus* larvae differ from larvae of these taxa, except *Nebrioporus*, by the absence of a maxillary cardo, absence of a lateral pore on antennomere 3, presence of an occipital suture in instar I, and by the extremely elongate urogomphi. The discrimination of *Nebrioporus* from *Stictotarsus* is more difficult though. Worldwide, only a few larvae of these two genera have been described. The only reliable character discovered for separating these genera is the relative length of the frontoclypeus. In *Nebrioporus*, the head capsule is more elongate than in *Stictotarsus*. However, that particular feature might not hold up when the larvae of more species are known.

The larvae of the Holarctic species *Stictotarsus griseostriatus* have been described (Bertrand 1928) from European material. However, as pointed out by Nilsson and Holmen (1995), the larva described by Bertrand (1928) could represent another species.

Genus *Nebrioporus* Régimbart
Fig. 230B

Diagnosis. Ocularium present; maxillary cardo absent; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae presentin instar II and III; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae present in instar II and III; basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1.

Instar I.

Head. Head length = 0.56 – 0.62 mm; head width = 0.42 – 0.52 mm; head length: head width = 1.20 – 1.32; **head capsule** pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture present; frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo absent; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 distinctly longer than LB1.

Thorax. Legs without natatory setae.

Abdomen. LLAS = 0.15–0.16 mm; urogomphus L = 1.20–1.22 mm; segment 8 slender, short, and subtrapezoidal, lateral margin subparallel, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon short, subtriangular in outline, with lateral margin straight, bluntly pointed apically; urogomphus about 7.50–8.10x LLAS; urogomphomere 1 longer than urogomphomere 2; basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Instar II. As instar I except for the following characters:

Head. Head length = 0.88 – 0.93 mm; head width = 0.66 – 0.76 mm; head length: head width = 1.22 – 1.31.

Thorax. Legs with natatory setae present.

Abdomen. LLAS = 0.26–0.29 mm; urogomphus L = 2.08–2.15 mm; segments 3 to 6 membranous ventrally; urogomphus elongate, about 7.20–8.30x LLAS; urogomphomere 1 with secondary setae.

Instar III (Fig. 230B). As for instar II except for the following characters:

Head. Head length = 1.30 – 1.38 mm; head width = 1.03 – 1.15 mm; head length: head width = 1.13 – 1.26. **Labium**, LB2 subequal to LB1 in length.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.39–0.50 mm; urogomphus L = 2.76–3.23 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 6.00–7.20x LLAS.

Comments. In North America, only the larva of *Nebrioporus rotundatus* has been described (Bertrand 1928; Barman 1972).

See under *Stictotarsus*.

Genus *Oreodytes* Seidlitz

Figs. 207; 208; 231

Diagnosis. Ocularium present; maxillary cardo absent; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae absent; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed without extended tracheal trunk apically; urogomphus distinctly longer

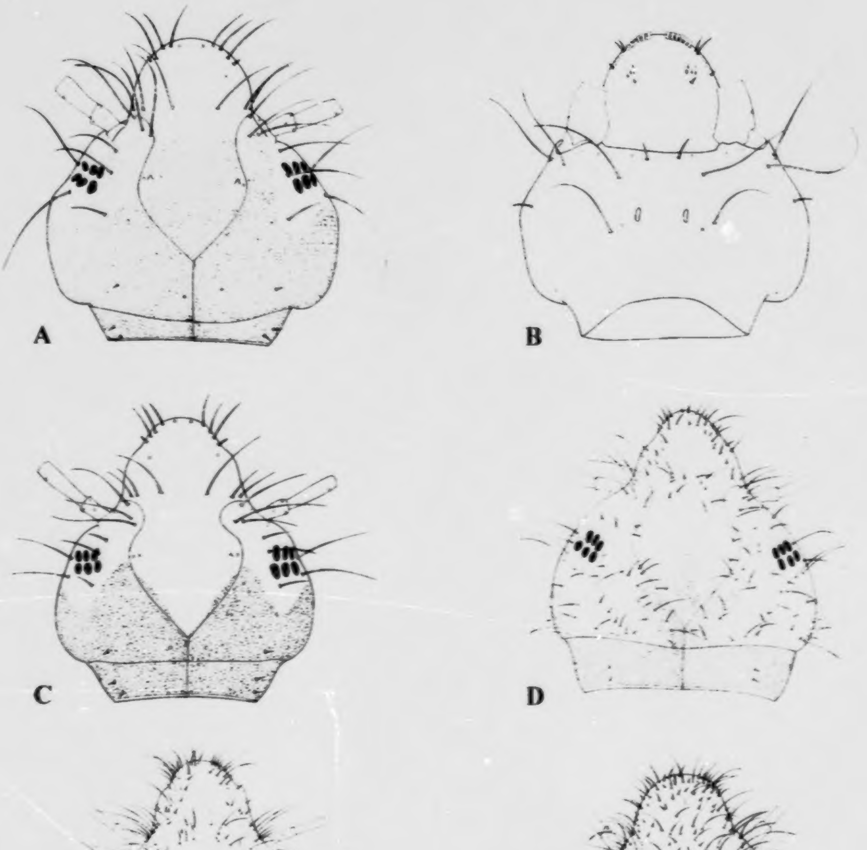

Fig. 207. Hydroporinae, *Oreodytes* head capsule. A – C - instar I. A, B - *O. picturatus*, A - dorsal, B - ventral. C - *O. quadrimaculatus*, dorsal. D – G - instar III, dorsal. D - *O. laevis*. E - *O. quadrimaculatus*. F - *O. abbreviatus*. G - *O. picturatus*. Drawn to different scales.

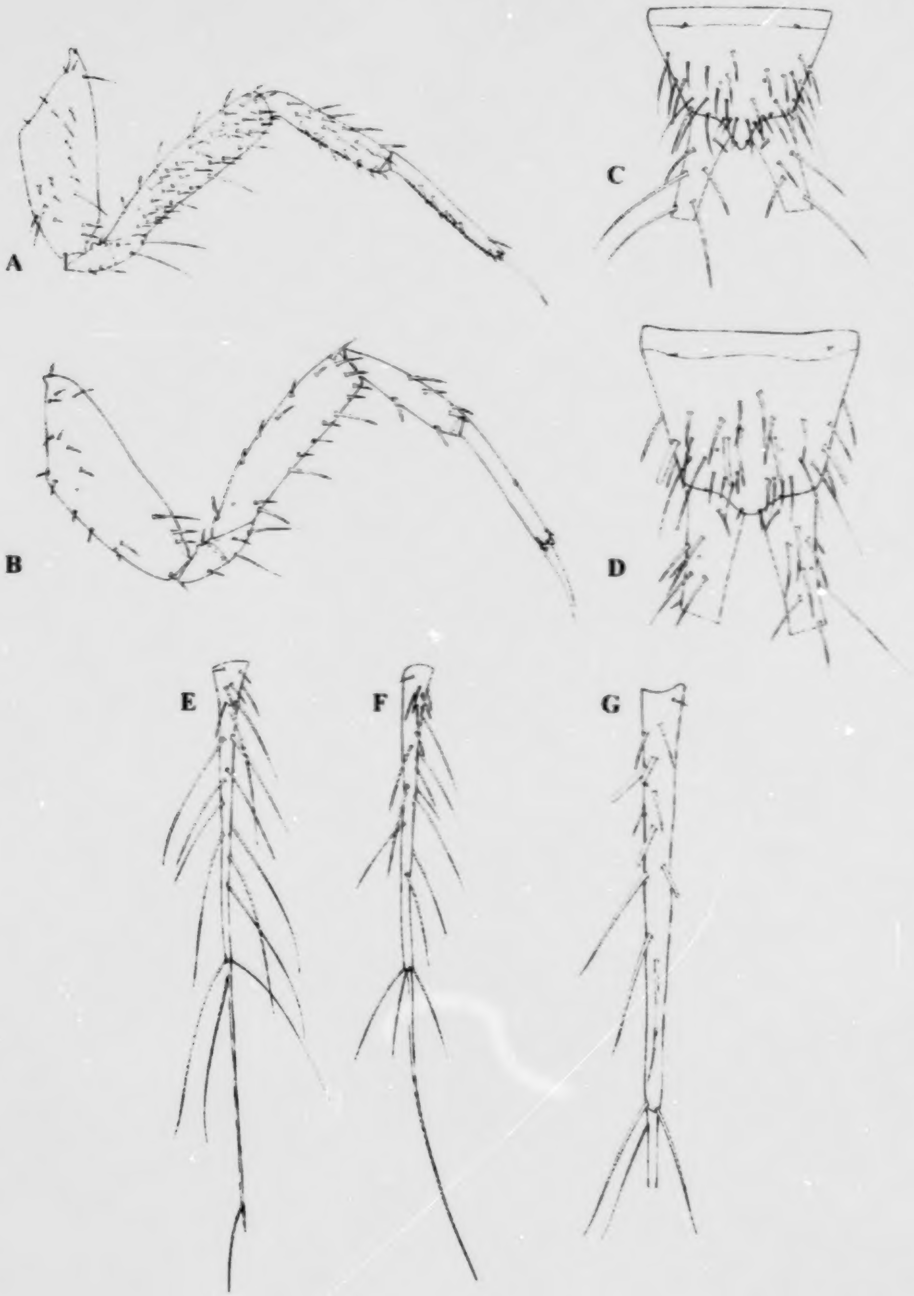

Fig. 208. Hydroporinae, *Oreodytes* instar III. A, B - metathoracic leg, anterior. A - *O. quadrimaculatus*. B - *O. sierrae*. C, D - last abdominal segment, dorsal. C - *O. obesus*. D - *O. picturatus*. E - G - urogomphus, dorsal. E - *O. quadrimaculatus*. F - *O. picturatus*. G - *O. angustior*. Drawn to different scales.

than abdomen segment 8; urogomphomere 1 with secondary setae present in instar II and III; basal articulations of primary setae UR2, UR3, and UR4 variously positioned on urogomphomere 1.

Instar I (Fig. 207A – C).
Head. Head length = 0.42 – 0.69 mm; head width = 0.40 – 0.63 mm; head length: head width = 0.98 – 1.17; **head capsule** (Fig. 207A – C): pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, about as long as broad; cervical region well delimited, temporal angle distinct (i.e., lateral margin constricted posteriorly); occipital suture present; frontoclypeus with lateral notches absent or slightly developed; ocularium present; **mandible** not serrate; **maxilla** with cardo absent; **labium** with prementum trapezoidal to subrectangular; anterior margin of prementum slightly concave medially; LB2 variable, subequal in length to distinctly longer than LB1.

Thorax. Legs without natatory setae.

Abdomen. LLAS = 0.12–0.21 mm; urogomphus L = 0.62–1.43 mm; segment 8 slender, short, and subtrapezoidal, lateral margin subparallel, slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; urogomphus about 4.37–8.70x LLAS; urogomphomere 1 subequal to or longer than urogomphomere 2; basal articulations of primary setae UR2, UR3, and UR4 variously positioned on urogomphomere 1: basal articulations contiguous or about subequally distant; seta UR8 variously positioned on urogomphomere 2: subterminal, articulated distally or terminal.

Instar II. As instar I except for the following characters:
Head. Head length = 0.55 – 0.97 mm; head width = 0.51 – 0.89 mm; head length: head width = 0.94 – 1.12.

Thorax. Legs with natatory setae absent (Fig. 208A, B).

Abdomen. LLAS = 0.17–0.34 mm; urogomphus L = 0.80–2.20 mm; segments 3 to 6 membranous ventrally; urogomphus about 4.30–7.27x LLAS; urogomphomere 1 with numerous secondary setae.

Instar III (Figs. 207D–G; 208; 231). As for instar II except for the following characters:
Head. Head length = 0.70 – 1.35 mm; head width = 0.68 – 1.30 mm; head length: head width = 1.00 – 1.20;
labium, LB2 shorter to longer than LB1.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.23–0.53 mm; urogomphus L = 0.85–2.91 mm; segments 1 to 7 each with a pair of spiracles on pleural region; abdomen segments 2 to 6 membranous ventrally; urogomphus about 3.51–6.37x LLAS.

Comments. A close relationship between the larvae of *Oreodytes*, *Stictotarsus* and *Nebrioporus* is indicated by absence of the maxillary cardo, the elongate urogomphus, and the presence of an occipital suture in instar I. However, *Oreodytes* larvae differ from those of the other two genera by the head capsule which is clearly constricted posteriorly, natatory setae absent from legs, head capsule less elongate, and a relatively less elongate urogomphus when compared with length of abdomen segment 8.

Except for *O. rhyacophilus* and *O. humboldtensis*, larvae of all North American species of *Oreodytes* have been described (Alarie 1997). The larval classification of *Oreodytes* is only partly reconcilable with the adult classification. Zimmerman (1985) recognized three species groups but larval characteristics suggest four groups, namely the *O. picturatus*, *O. obesus*, *O. scitulus*, and *O. quadrimaculatus* groups.

The *O. picturatus*-group contains two species, *O. picturatus* and *O. angustior*. Both species are characterized by the presence of blunt secondary setae over some parts of their body (Fig. 208D, F) as well as by the terminal position of primary seta UR8 on urogomphomere 2 (Fig. 208F). Larvae of the *O. obesus* -group (*O. obesus*, *O. congruus*, *O. sanmarkii*, *O. crassulus*, *O. sierrae*, *O. abbreviatus*) are easily recognized because of their broad fusiformate body shape (Fig. 231B) and small size. The head appendages and legs of these species are also slightly shorter than in other species of the genus. Larvae of the *O. scitulus*-group (*O. scitulus*, *O. snoqualmie*, *O. laevis*, *O. recticollis*, *O. productotruncatus*, *O. alaskanus*, *O. humboldtensis*) are characterized by their larger size, narrower body shape (Fig. 231A), elongate urogomphus, and the presence of spinulae along the ventral margin of the tibiae and tarsi. Finally, the monotypic *O. quadrimaculatus*-group contains a medium-sized species which differs from other species of *Oreodytes* by the presence of a lateral pore on antennomere 3, and the more proximal insertion of the seta UR8 on urogomphomere 2.

Genus *Hydrovatus* Motschulsky
Fig. 225B

Diagnosis. Ocularium present; maxillary cardo present; prementum subquadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae absent; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 not constricted posterior to insertion of urogomphi; siphon acutely pointed, without extended tracheal trunk apically; urogomphus slightly but distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae absent; basal articulations of primary setae UR2, UR3, and UR4 contiguous on urogomphomere 1.

Instars I and II. Unknown.

Instar III (Fig. 225A,B).
Head. Head length = 0.70 – 0.90 mm; head width = 0.40 mm; head length: head width = 1.40 – 1.80; **head capsule** pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture present; frontoclypeus with lateral notches weakly developed, ocularium present; **mandible** not serrate; **maxilla** with cardo present; **labium** with prementum trapezoidal; anterior margin of prementum slightly concave medially; LB2 slightly longer than LB1.

Thorax. mesothorax with a pair of spiracular openings on pleural region. **Legs** without natatory setae.

Abdomen. LLAS = 0.35–0.50 mm; urogomphus L = 0.55–0.75 mm; segments 1 to 7 with a pair of spiracular openings; segments 2 to 6 membranous ventrally; segment 8 conical, lateral margin evenly and strongly converging from base to apex of siphon not constricted at point of insertion of urogomphus; siphon elongate, subtriangular in outline, sharply pointed apically; urogomphus about 1.50x LLAS; urogomphomere 1 shorter than urogomphomere 2, with only primary setae; basal articulations of primary setae UR2, UR3, and UR4 contiguous; the relative position of seta UR8 is unknown.

Comments. Superficially, the larvae of *Hydrovatus* may be confused with those of *Desmopachria* owing to the overall shape of the body. However, *Hydrovatus* larvae differ from *Desmopachria* larvae by the frontoclypeus broader basally and very elongate, presence of a maxillary cardo, absence of natatory setae on legs, absence of secondary setae on urogomphus, abdomen segments 2 to 6 membranous ventrally, and urogomphus with basal articulations of primary setae UR2, UR3 and UR4 contiguous.

Genus *Desmopachria* Babington
Figs. 198I; 209; 225A

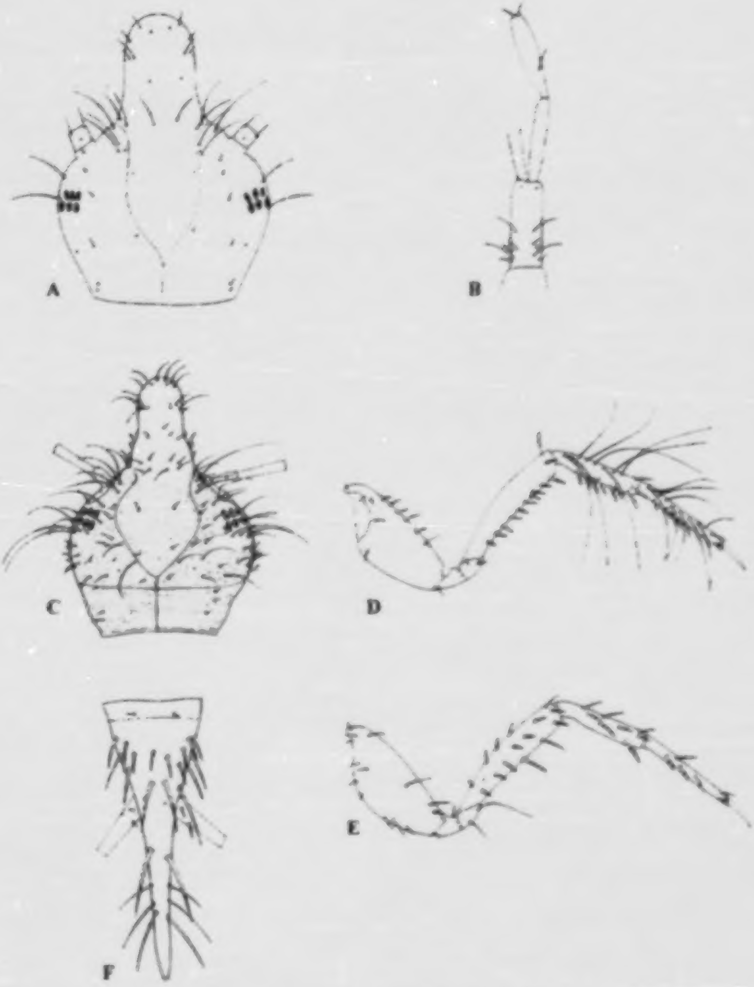

Fig. 209. Hydroporinae, *Desmopachria convexa*. A – B - instar I, dorsal. A - head capsule. B - labium. C – F - instar III. C - head capsule, dorsal. D - metathoracic leg, posterior. E - metathoracic leg, anterior. F - last abdominal segment, dorsal. Drawn to different scales

Diagnosis. Ocularium present; maxillary cardo absent; prementum subrectangular, narrower than long; labial palpomere 2 club-shaped in instar I; antennomere 2 without seta; legs with natatory setae present in instar II and III; spiracular openings present in instar III; abdomen segments 2 to 8 sclerified ventrally in third instar; abdomen segment 8 not constricted posterior to insertion of urogomphi; siphon acutely pointed, without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae present in instar II and III; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 inserted more distally on urogomphomere 1.

Instar I (Figs. 198I; 209A, B).

Head. Head length = 0.33 – 0.35 mm; head width = 0.20 – 0.24 mm; head length: head width = 1.54; **head capsule** (Fig. 209A): pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus narrow, without lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo absent; **labium** (Fig. 209B) with prementum narrower than long, subrectangular; anterior margin of prementum slightly concave medially; LB2 longer than LB1 and club-shaped.

Thorax. Legs without natatory setae.

Abdomen. LLAS = 0.24–0.25 mm; urogomphus L = 0.59–0.67 mm; segment 8 slender, elongate, and subconical, lateral margin straight, strongly and evenly converging from base to apex of siphon, slightly constricted posterior to insertion of urogomphi; siphon elongate, subtriangular in outline, fairly acute apically; urogomphus 2.34–2.80x LLAS; urogomphomere 1 shorter than urogomphomere 2; basal articulations of primary setae UR2 and UR3 contiguous, seta UR4 inserted more distally on urogomphomere 1; seta UR8 subproximal in position, articulated basally on urogomphomere 2, proximad to apex of urogomphomere 1 (Fig. 198I).

Instar II. As instar I except for the following characters:
Head. Head length = 0.45 – 0.47 mm; head width = 0.31 – 0.33 mm; head length: head width = 1.41–1.45; **labium:** LB2 subequal to LB1, more slightly club-shaped.

Thorax. Legs with natatory setae present (Fig. 209D).

Abdomen. LLAS = 0.39–0.41 mm; urogomphus L = 0.69–0.74 mm; segments 3 to 6 with a ventral plate, segment 7 with separate but approximate dorsal and ventral plate; urogomphus about 1.68–1.85x LLAS; urogomphomere 1 with one secondary seta.

Instar III (Figs. 209C–F; 225A). As for instar II except for the following characters:
Head. Head length = 0.55 – 0.62 mm; head width = 0.44 – 0.45 mm; head length: head width = 1.29 – 1.38; **labium**: LB2 distinctly shorter than LB1.

Thorax (Fig. 209D, E). Mesothorax with a pair of spiracles on pleural region.

Abdomen (Fig. 209F). LLAS = 0.56 – 0.61 mm; urogomphus L = 0.72 – 0.85 mm; segments 1 to 7 with a pair of spiracles on pleural region; segments 2 to 6 with a ventral sclerified plate; urogomphus about 1.28 – 1.39x LLAS; urogomphomere 1 with a few secondary setae.

Comments. The larvae of *Desmopachria* are unique among Hydroporinae. Because of their spindle-shape and gibbous appearance and the fairly acute siphon, *Desmopachria* larvae may be confused with those of *Hydrovatus* (see under *Hydrovatus*). *Pachydrus* and *Desmopachria* are the only representives of the tribe Hyphydrini in North America. However, both genera are distinctive as *Desmopachria* is characterized by prementum longer than broad, abdomen segments 4 and 5 with a ventral plate, urogomphus longer than abdomen segment 8, presence of both a lateral pore and a ventroapical spinula on antennomere 3, primary seta UR8 inserted more proximally on urogomphomere 2, antennomere 1 distinctly shorter (compared to subequal in length) than antennomeres 2 and 3 (instar III) and absence of natatory setae on ventral margin of femora.

Desmopachria convexa is the only species of *Desmopachria* known as larvae (Alarie *et al.* 1997). Barman (1972), in describing the larvae of *D. convexa*, erroneously reported the absence of natatory setae on legs, and of secondary setae on urogomphus.

Genus *Pachydrus* Sharp

Fig. 210

Diagnosis. Ocularium present; maxillary cardo absent; prementum subquadrangular, about as long as broad; antennomere 2 without seta; legs with natatory setae present in instar III (not known for instar II); spiracular openings present in instar III; abdomen segments 6 to 8 sclerified ventrally in third instar; abdomen segment 8 not constricted posterior to insertion of urogomphi; siphon bluntly rounded apically, without extended tracheal trunk apically; urogomphus shorter than abdomen segment 8; urogomphomere 1 with secondary setae present in instar III (not known for instar II).

Instars I and II. Unknown.

Instar III (Fig. 210).
Head. Head length = 1.06 – 1.16 mm; head width = 0.84 – 0.89 mm; head length: head width = 1.26 – 1.31; **head capsule** (Fig. 210C, D): pear-shaped in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e. lateral margin not constricted posteriorly); occipital suture present; frontoclypeus with lateral notches visible dorsally, ocularium present; **mandible** not serrate; **maxilla** with cardo absent; **labium** with prementum subquadrangular; anterior margin of prementum slightly concave medially; LB2 shorter than LB1.

Thorax. Mesothorax with a pair of spiracular openings on pleural region.

Legs (Fig. 210E, F) with natatory setae on dorsal and ventral margin of femora and tibiae respectively.

Abdomen. LLAS = 0.97–1.17 mm; urogomphus L = 0.47–0.54 mm; segments 1 to 7 with a pair of spiracular openings; segments 2 to 5 membranous ventrally, segments 6–8 fully sclerotized; segment 8 conical, lateral margin evenly and strongly converging from base to apex of siphon, not constricted at point of insertion of urogomphus; siphon elongate, subtriangular in outline, bluntly rounded apically; urogomphus about 0.44–0.49x LLAS; urogomphomere 1 longer than urogomphomere 2, with secondary setae; relative positions of primary setae UR2, UR3, and UR4 not determined; seta UR8 proximally articulated on urogomphomere 2.

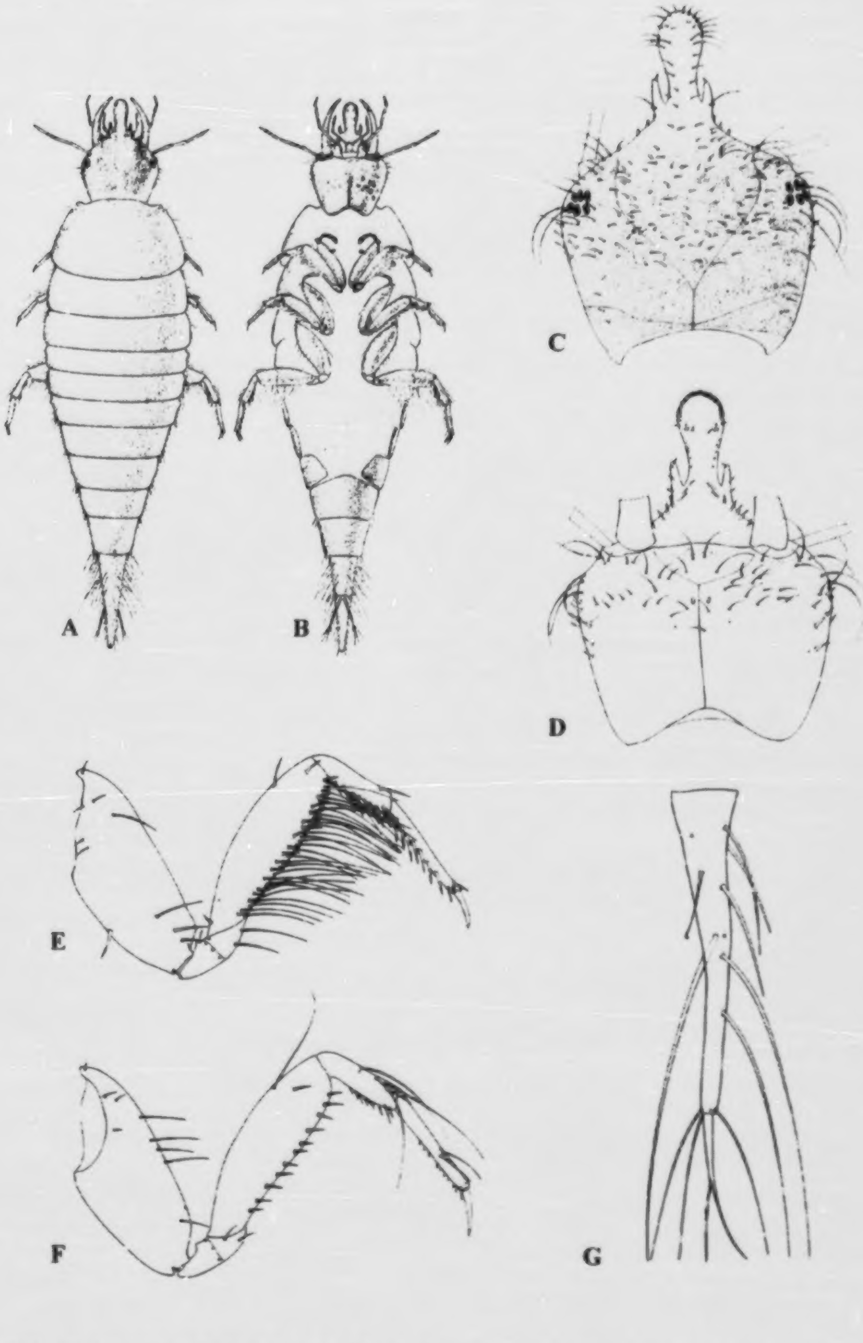

Fig. 210. Hydroporinae, *Pachydrus* instar III. A, B - *P. princeps* habitus, A - dorsal, B - ventral (after Spangler and Folkerts 1973). C – G - *Pachydrus globosus*. C - head capsule, dorsal. D - head capsule, ventral. E - metathoracic leg, anterior. F - metathoracic leg, posterior. G - urogomphus, dorsal. Drawn to different scales.

Comments. In North America, the mature larva of *P. princeps* has been described (Spangler and Folkerts 1973). See also under *Desmopachria*.

Genus *Celina* Aubé
Figs 211A - C

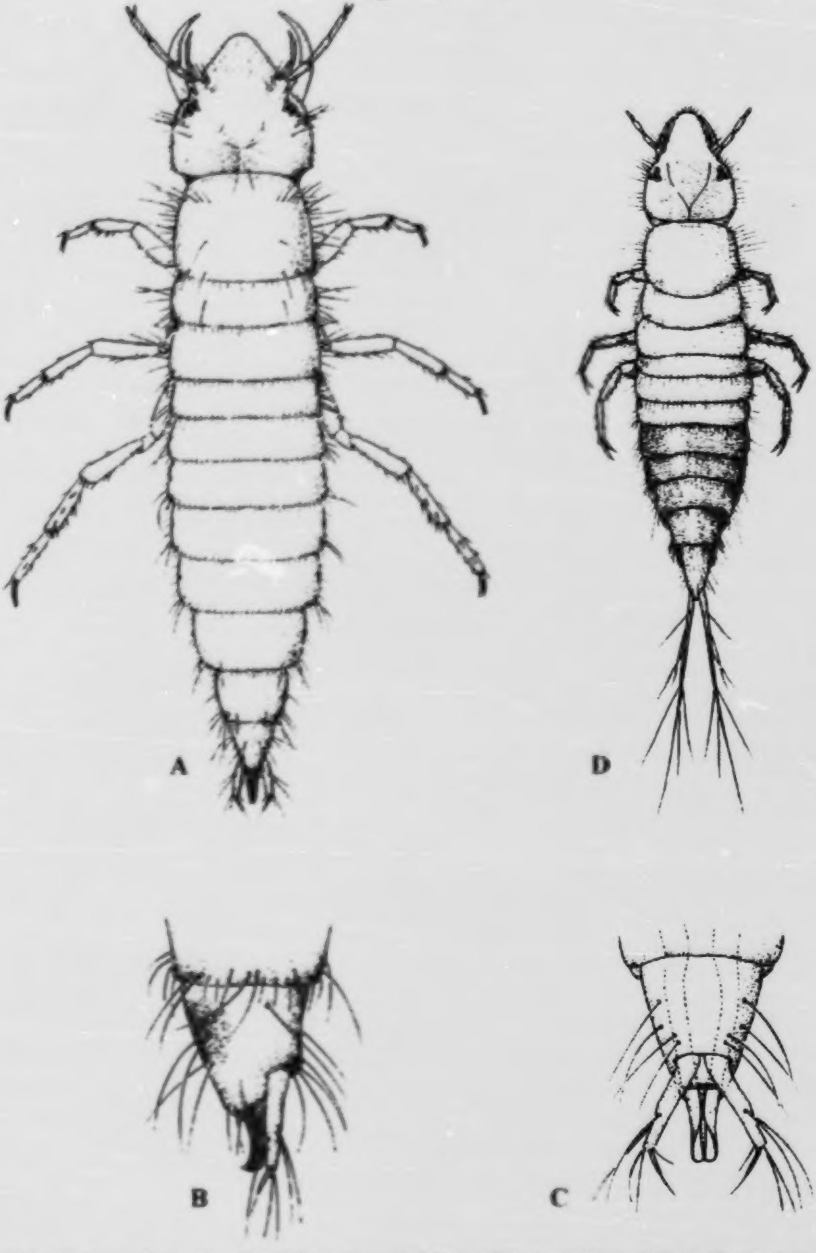

Fig. 211. Hydroporinae. A – C - *Celina angustata* instar III. A - habitus, dorsal. B, C - last abdominal segment, B - lateral, C - ventral (after Spangler 1973). D - *Neoclypeodytes cinctellus* instar III, dorsal habitus (after Perkins 1980). Drawn to different scales.

Diagnosis. Ocularium present; maxillary cardo present; prementum quadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae absent; spiracular openings present in instar III; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 not constricted posterior to insertion of urogomphi; siphon bluntly pointed, with extended tracheal trunk apically; urogomphus slightly shorter than abdomen segment 8; urogomphomere 1 with secondary setae absent; basal articulations of primary setae UR2, UR3, and UR4 contiguous on urogomphomere 1.

Instars I and II. Unknown.

Instar III .
Head (Fig. 211A). Head length = 0.87 mm; head width = 0.71 mm; head length: head width = 1.23; **head capsule:** broadly sagittate, in dorsal view, widest posterior to stemmata, very slightly tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (lateral margin very slightly constricted posteriorly); occipital suture present; frontoclypeus without lateral notches; ocularium present; **mandible** not serrate; **maxilla** with cardo present; **labium** with prementum narrow and subquadrate; anterior margin of prementum slightly concave medially; LB2 subequal to LB1 in length.

Thorax. Mesothorax with a pair of spiracular openings on pleural region. **Legs** without natatory setae.

Abdomen (Fig. 211A – C). LLAS = 0.41 mm; urogomphus L = 0.28 mm; segments 1 to 7 with a pair of spiracular openings; segments 2 to 6 membranous ventrally; segment 8 conical, lateral margin evenly and strongly converging from base to apex of siphon, not constricted posterior to point of insertion of urogomphi; siphon short, subtriangular in outline, bluntly pointed and with a recurved extension of the lateral tracheal trunk apically; urogomphus about 0.70x LLAS; urogomphomere 1 distinctly longer than urogomphomere 2 with secondary setae absent; basal articulations of primary setae UR2, UR3, and UR4 contiguous on urogomphomere 1; seta UR8 inserted apically on urogomphomere 2.

Comments. The presence of a recurved extension of the lateral tracheal trunk at the apex of the siphon makes *Celina* a very distinctive genus within Dytiscidae. Spangler (1973) suggested that this structure is used by the larva to puncture aerenchimentous plant tissues to replenish its air supply underwater. The species *C. angustata* Aubé is the only representative of the genus known as larva (instar III).

Genus *Liodessus* Guignot
Fig. 228B

Diagnosis. Ocularium present; maxillary cardo absent; prementum quadrangular; labial palpomere 2 subcylindrical; antennomere 2 without seta; legs with natatory setae absent; spiracular openings present in instar III larva; abdomen segments 2 to 6 membranous ventrally; abdomen segment 8 constricted posterior to insertion of urogomphi; siphon bluntly pointed, without extended tracheal trunk apically; urogomphus distinctly longer than abdomen segment 8; urogomphomere 1 with secondary setae absent; basal articulations of primary setae UR2, UR3, and UR4 about subequally distant on urogomphomere 1.

Instar I.

Head. Head length = 0.34 mm; head width = 0.25 mm; head length: head width = 1.36; **head capsule:** broadly ovate in dorsal view, widest posterior to stemmata, tapering posteriorly, longer than broad; cervical region not delimited, temporal angle indistinct (i.e., lateral margin not constricted posteriorly); occipital suture absent; frontoclypeus with lateral notches; ocularium present; **mandible** not serrate; **maxilla** without cardo; **labium** with prementum trapezoidal; anterior margin of prementum V-shaped medially; LB2 distinctly longer than LB1.

Thorax. Legs without natatory setae.

Abdomen. LLAS = 0.13 mm; urogomphus L = 0.76 mm; segment 8 slender, more or less elongate, and feebly conical, lateral margin subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon moderately elongate, subtriangular in outline, with lateral margin distinctly constricted, bluntly pointed apically; urogomphus about 5.85x LLAS; urogomphomere 1 slightly longer than urogomphomere 1; basal articulations of primary setae, UR2, UR3, and UR4 about subequally positioned on urogomphomere 1; seta UR8 subterminal in position, articulated distally on urogomphomere 2.

Instar II. As instar I except for the following characters:

Head. Head length = 0.42 – 0.46 mm; head width = 0.34 – 0.36 mm; head length: head width = 1.24–1.32; **head capsule**: occipital suture present.

Thorax. Legs with natatory setae absent.

Abdomen. LLAS = 0.22–0.23 mm; urogomphus L = 1.01–1.10 mm; segment 3 to 6 membranous ventrally; urogomphus about 4.70–5.00x LLAS; urogomphomere 1 without secondary setae.

Instar III (Fig. 228B). As for instar II except for the following characters:

Head. Head length = 0.62 mm; head width = 0.48 mm; head length: head width = 1.29; **labium**, LB2 slightly longer than LB1.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.35–0.37 mm; urogomphus L = 1.18–1.22 mm; segments 1 to 7 each with a pair of spiracles on pleural region; segments 2 to 6 membranous ventrally; urogomphus about 3.29–3.37x LLAS.

Comments. The tribe Bidessini contains the smallest species within the fauna. This feature is useful for diagnosis. Larvae of *Liodessus* differ from those of *Neoclypeodytes* (Matta 1983) and *Uvarus* by the relative length of the urogomphus. In *Liodessus* the urogomphus is more than three times longer than abdomen segment 8 whilst it is subequal to slightly longer in *Uvarus* and *Neoclypeodytes*. The relative lengths of labial palomeres 1 and 2 is also useful for distinguishing *Liodessus* and *Neoclypeodytes* from *Uvarus*. Based on the description given by Matta (1983), labial palpomere 2 is distinctively shorter than labial palpomere 1 in *Uvarus*, subequal, in *Neoclypeodytes* (Perkins 1980), and slightly longer in *Liodessus*.

In the Nearctic, *L. affinis* is the only member of *Liodessus* known as larva (Watts 1970; Matta (1983).

Genus *Uvarus* Guignot

Remark: No specimens of *Uvarus* were available for this study. The description by Matta (1983) of the mature larva of *U. granarius* (Aubé) is too superficial to be used under the descriptive format followed in this book. See under *Liodessus* for additional comments.

Genus *Neoclypeodytes* Young

Fig. 211D

Remark: No specimens of *Neoclypeodytes* were available for this study. The description of Perkins (1980) of the mature larva of *N. cinctellus* (leConte) is too superficial to be used under the descriptive format followed in this book. See under *Liodessus* for additional comments.

Subfamily Hydrotrupinae Roughley

Figs. 212; 213

Diagnosis. Small size; frontoclypeus not developed into a frontal projection (nasale), triangular in outline and with four clypeolabral setae in instar I; coronal suture elongate, more than 0.30–0.40x head length; occipital suture lacking; mandible not channelled, not curved upward apically; maxillary galea present, 1-segmented, finger-like; maxillary palpifer well-developed; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 lacking lateral tracheal gills; abdomen segment 6 membranous ventrally in instar III; abdomen segments 7 and 8 lacking a lateral fringe of natatory setae; siphon with lateral lobes and lanceolate setae; urogomphus 2-segmented, distinctly longer than LLAS, with primary setae only in instar I.

Genus *Hydrotrupes* Sharp

Figs. 212; 213

Instar I (Fig. 212).

Head (Fig. 212A). Head length = 0.45 - 0.46 mm; head width = 0.51 – 0.55 mm; head length: head width = 0.84 – 0.86; **head capsule:** rounded, broader than long; cervical region well-marked, temporal angle well-delimited (i.e. lateral margin distinctly constricted posteriorly); occipital suture absent; epicranial suture well-developed, coronal suture elongate, 0.30–0.40x as long as head length; frontoclypeus not developed anteriorly in a nasale, with anterior margin slightly arcuate, with a lateral lobe on each side, triangular in outline,with four club-shaped clypeolabral setae; egg-bursters present; occipital foramen not indented ventrally, straight dorsally; stemmata subequal in size; **antenna** (Fig. 212B, C): biramous, distinctly shorter than head length; A1 to A3 not secondarily subdivided; A4 distinctly shorter than A3; **mandible** (Fig. 212H): not channelled, broad and sharply falcate, not curved upward apically, inner margin minutely serrated on distal half, lacking a tuft of small hairs; **maxilla** (Fig. 212D – E): with cardo reduced, subovate to subrectangular; stipes short and thick, with inner margin setose proximad to galea and lacking hook-like structures; galea 1-segmented, finger-like; palpifer well-developed, similar to a palpomere; MX1 to MX3 not secondarily subdivided, MX3 subequal to MX2; **labium** (Fig. 212F, G): with prementum subrectangular (broader than long); anterior margin of prementum straight to slightly concave medially; ligula absent; LB1 and LB2 not secondarily subdivided, LB2 longer than LB1.

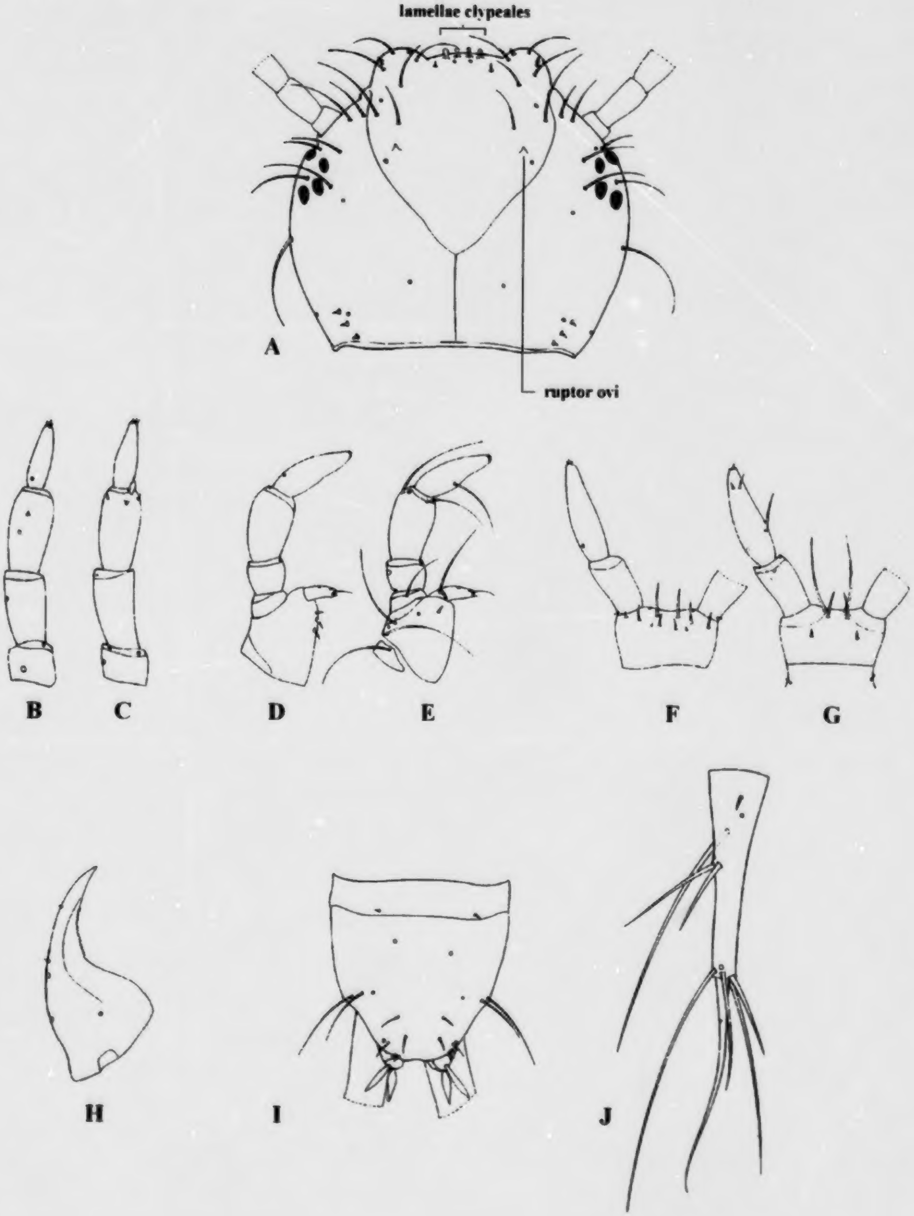
lamellae clypeales
A
ruptor ovi
B
C
D
E
F
G
H
I
J

Fig. 212. Hydrotrupinae, *Hydrotrupes palpalis*, instar I.. A - head capsule, dorsal. B, C - antenna, B - dorsal, C - ventral. D, E - maxilla, D - dorsal, E - ventral. F, G - labium, F - dorsal, G - ventral. H - mandible, dorsal. I - last abdominal segment, dorsal. J - urogomphus, dorsal. Drawn to different scales.

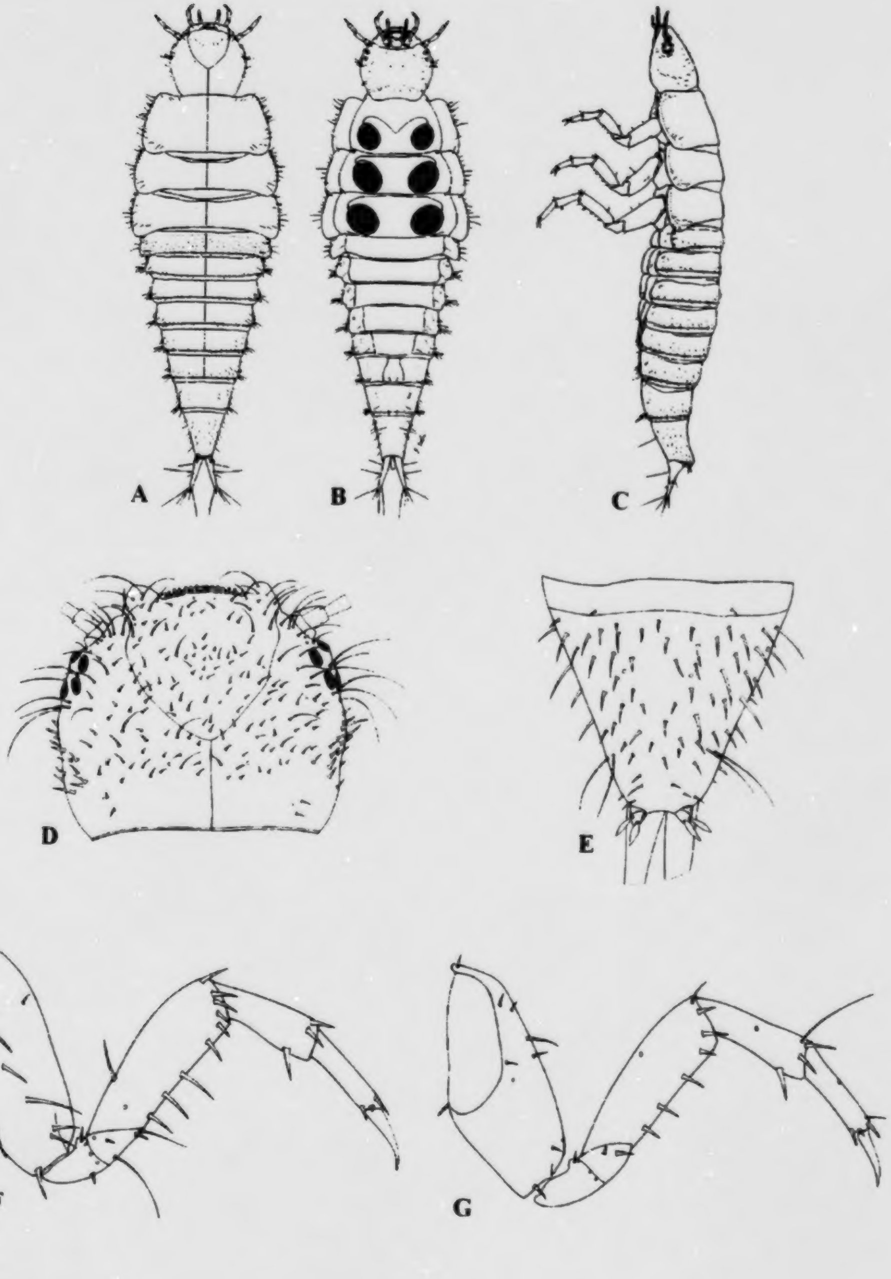

Fig. 213. Hydrotrupinae, *Hydrotrupes palpalis*, instar III. A – C - habitus, A - dorsal, B - ventral, C - lateral. D - head capsule, dorsal. E - last abdominal segment, dorsal. F – G - metathoracic leg, F - anterior, G - posterior. Drawn to different scales.

Thorax. Legs: without natatory setae; pro- and mesothoracic legs not pseudo-chelate; tarsal claw with basoventral spinulae absent.

Abdomen (Fig. 212I, J). LLAS = 0.29–0.31 mm; urogomphus L = 0.72–0.77 mm; lacking lateral tracheal gills, fully sclerotized dorsally, membranous ventrally, except segment 7, partly sclerotized and segment 8 fully sclerotized; segments 7 and 8 lacking a fringe of natatory setae laterally; segment 8 with additional setae absent, slender, more or less elongate, subconical, with lateral margins subparallel to slightly converging from base to point of insertion of urogomphi, more abruptly converging thereafter; siphon short, subtriangular in outline with lateral margin slightly sinuate, broadly rounded apically, with lateral lobes and lanceolate setae on each side; urogomphus 2-segmented, lacking a subbasal suture, about 2.20–2.52x LLAS; urogomphomere 2 slightly longer than urogomphomere 1; urogomphus with additonal setae absent; primary setae UR2, UR3, and UR4 contiguously positioned on urogomphomere 1; primary seta UR8 inserted subapically on urogomphomere 1.

Instar II. As instar I except for the following characters:
Head. Head length = 0.58 – 0.61 mm; head width = 0.69 – 0.72 mm; head length: head width = 0.84 – 0.87; **head capsule:** parietals with a variable number of temporal spines anterad to cervical constriction; egg bursters absent; **maxilla**, MX3 shorter than MX2.

Abdomen. LLAS = 0.41–0.44 mm; urogomphus L = 0.75–0.85 mm; siphon relatively shorter than in instar I; segments 7 and 8 ventrally completely sclerotized; urogomphus 1.83–2.09x LLAS, with secondary setae absent (Figs. 212F; 212G).

Instar III (Fig. 213). As for instar II except for the following characters:
Head. Head length = 0.77 – 0.80 mm; head width = 0.89 – 0.96 mm; head length: head width = 0.83 – 0.87; **labium**, palpomere 2 subequal or slightly shorter than palpomere 1.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.56–0.62 mm; urogomphus L = 0.58–0.61 mm; segments 1 to 7 each with a pair of spiracles on pleural region; urogomphus about 0.99–1.06x LLAS.

Comments. Traditionally, *Hydrotrupes* has been treated as a member of the tribe Agabini (subfamily Colymbetinae) (Brinck 1948; Leech and Chandler 1956; Pederzani 1995; Nilsson and Roughley 1997). However, Beutel (1994) used, among other characters, the absence of a mandibular channel as an argument supporting a sister-group relationship between *Hydrotrupes* and the remaining Dytiscidae minus *Copelatus*. The larvae of *H. palpalis* were described recently (Alarie *et al.* 1998). Based on larval chaetotaxy, there seems to be no argument supporting a distinct placement of *Hydrotrupes* outside the Colymbetinae. Indeed, a sister-group relationship was proposed between *Hydrotrupes* and a clade comprised of *Agabus* and *Ilybius*. Larvae of *Hydrotrupes* may be distinguished from those of these two genera by the remarkably modified and autapomorphic lanceolate setae found apicolaterally on abdominal segment 8 (Figs. 212I; 213E).

Although the function of the specialized lanceolate setae is unknown, some anatomical observations are noteworthy. Each pair of lanceolate setae is mounted on a sclerotized plate that is immediately adjacent to, and approximately the same size as, the spiracular opening. The sclerotized plate is apparently movable, being positioned on flexible cuticle. This positioning, plus the fact that the flat surface of the setae is in the same plane as the hygropetric water flow, suggests that these setae are morphological specializations that somehow enhance the effectiveness of the respiratory system in the hygropetric microhabitat.

Subfamily Colymbetinae Erichson

Figs. 214 - 221; 232 – 234; 235A

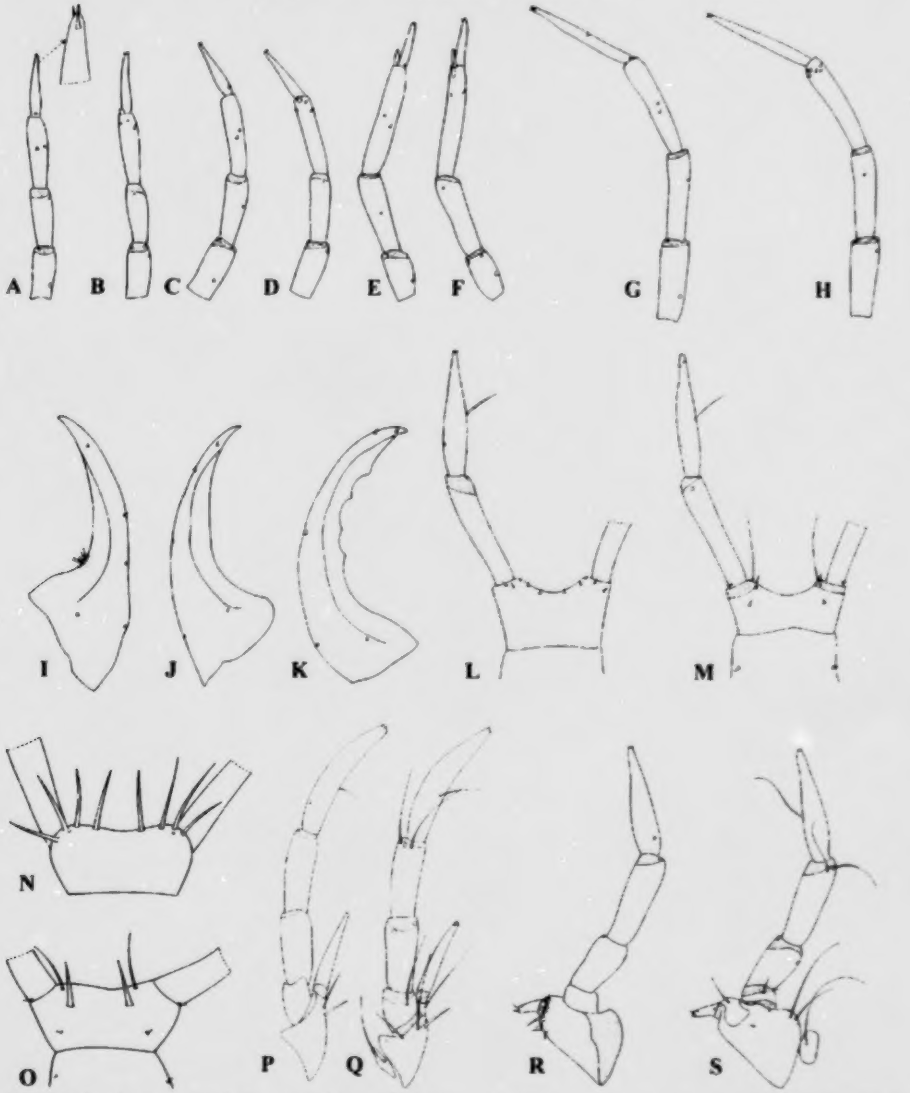

Fig 214. Colymbetinae, cephalic appendages of instar I. A – H - antenna. A – B - *Agabus anthracinus*, A - dorsal, B - ventral. C – D - *Ilybius subaeneus*, C - dorsal, D - ventral. E – F - *Matus bicarinatus*, E - dorsal, F - ventral. G – H - *Rhantus consimilis*, G - dorsal, H - ventral. I – K - mandible, dorsal. I - *Agabus anthracinus*. J - *Rhantus suturellus*. K - *Matus bicarinatus*. L – O - labium. L - M - *Agabus anthracinus*, L - dorsal, M - ventral. N - O -*Matus bicarinatus*, N - dorsal, O - ventral. P – S - maxilla. P - Q - *Matus bicarinatus*, P - dorsal, Q - ventral. R - S - *Agabus anthracinus*, R - dorsal, S - ventral. Drawn to different scales.

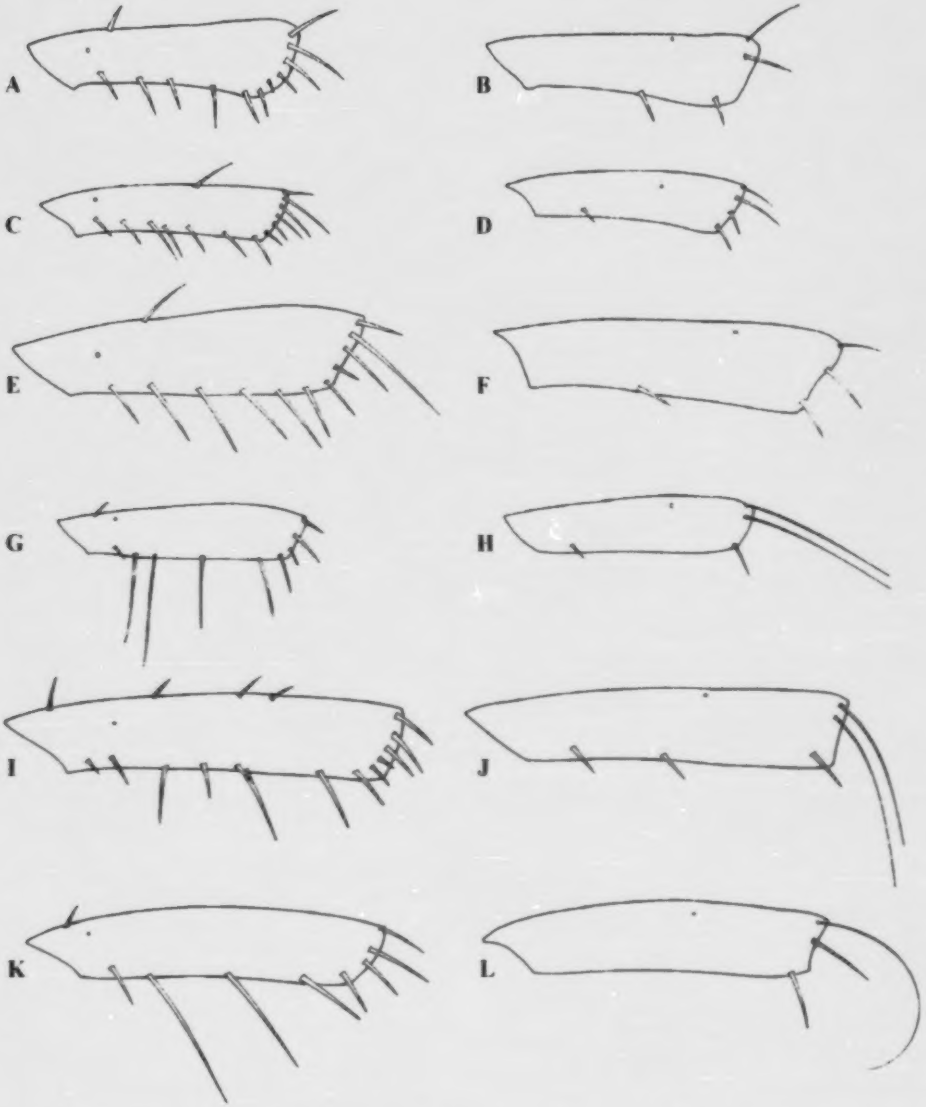

Fig. 215. Colymbetinae, metafemur of instar I. A – B - *Agabinus*, A - anterior, B - posterior. C – D - *Ilybius angustior*, C - anterior, D - posterior. E – F - *Agabus seriatus*, E - anterior, F - posterior. G – H - *Rhantus suturellus*, G - anterior, H - posterior. I – J - *Neoscutopterus hornii*, I - anterior, J - posterior. K – L - *Colymbetes paykulli*, K - anterior, L - posterior.

Diagnosis. Medium size; frontoclypeus not developed into a frontal projection (nasale), triangular in outline and with more than six clypeolabral setae in instar I; coronal suture elongate, more than 0.50x head length; occipital suture present or absent in instar II and III; mandible channelled, not curved upward apically; maxillary galea present, 1-segmented, finger-like; maxillary palpifer well-developed; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 lacking lateral tracheal gills;

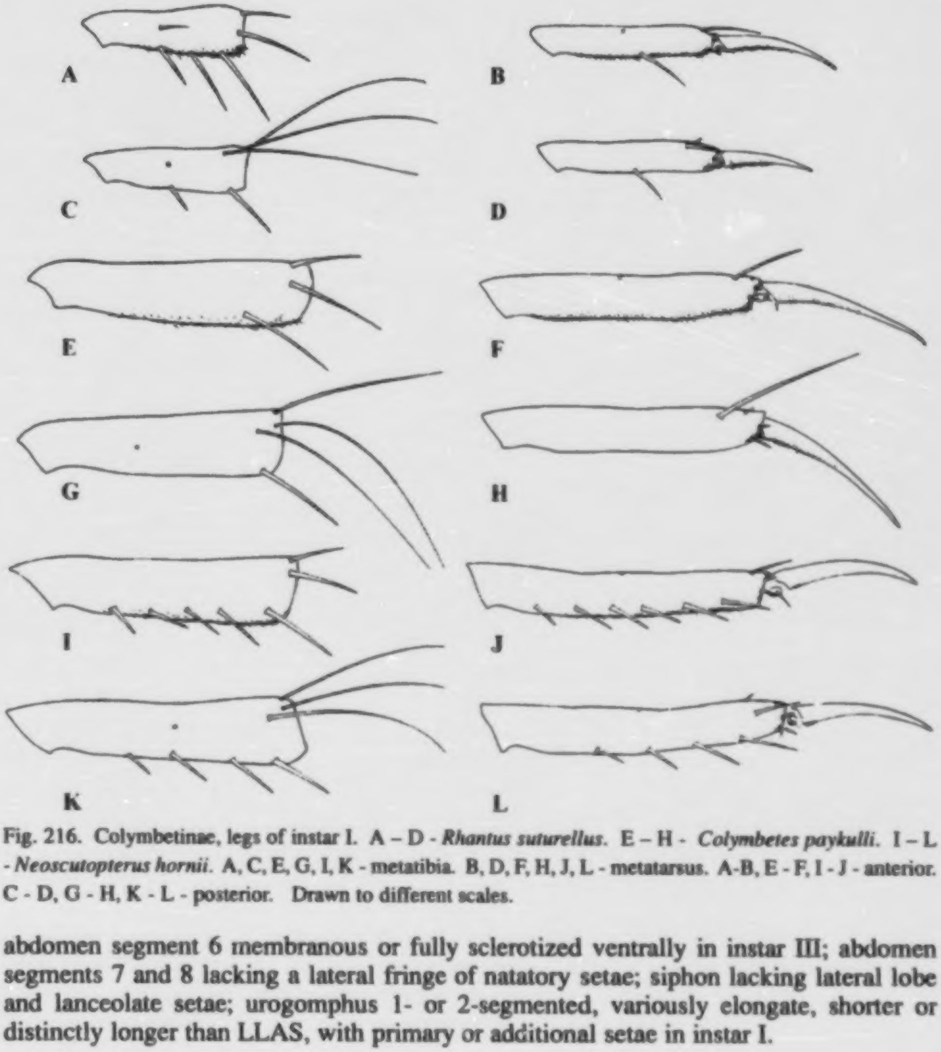

Fig. 216. Colymbetinae, legs of instar I. A – D - *Rhantus suturellus*. E – H - *Colymbetes paykulli*. I – L - *Neoscutopterus hornii*. A, C, E, G, I, K - metatibia. B, D, F, H, J, L - metatarsus. A-B, E - F, I - J - anterior. C - D, G - H, K - L - posterior. Drawn to different scales.

abdomen segment 6 membranous or fully sclerotized ventrally in instar III; abdomen segments 7 and 8 lacking a lateral fringe of natatory setae; siphon lacking lateral lobe and lanceolate setae; urogomphus 1- or 2-segmented, variously elongate, shorter or distinctly longer than LLAS, with primary or additional setae in instar I.

Instar I.

Head. Head length = 0.59 – 1.90 mm; head width = 0.60 – 1.74 mm; head length: head width = 0.90 – 1.39; **head capsule:** of various shape, triangular or subtriangular with lateral margin strongly diverging anteriorly, trapezoidal with lateral margin slightly to strongly divergent anteriorly, subquadrangular (or subrectangular) with parallel or subparallel sides, or rounded; subequal to or longer than broad; cervical region well-marked or not, temporal angle well-delimited or not (i.e., lateral margin distinctly constricted or not posteriorly); occipital suture absent or present; epicranial suture well-developed, coronal suture elongate, usually more than 0.50x as long as head length; frontoclypeus triangular in outline, not developed anteriorly in a nasale, with anterior margin at most slightly arcuate, with a lateral lobe on each side present or not, with a variable number of either club-shaped or spine-like clypeolabral setae; egg-bursters present; occipital foramen weakly indented ventrally, straight dorsally; stemmata

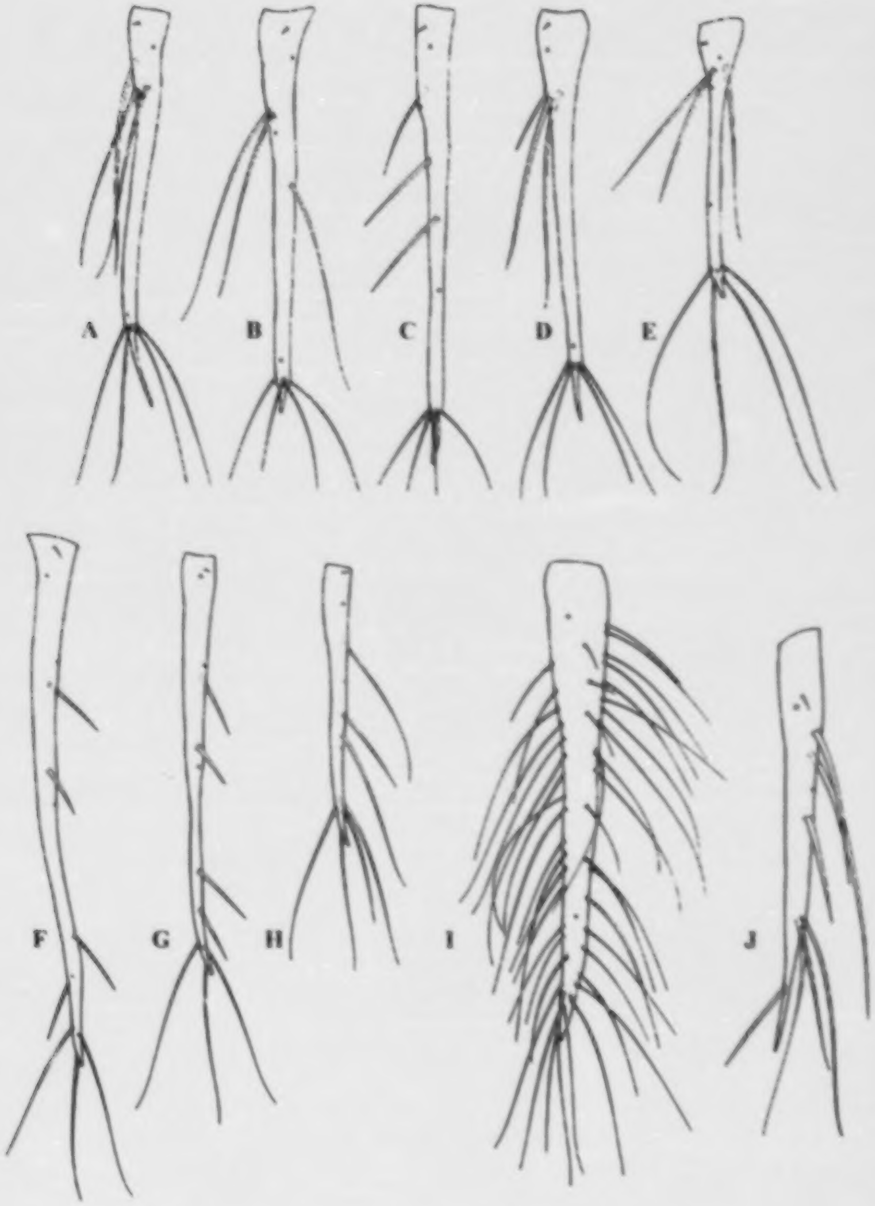

Fig. 217. Colymbetinae, urogomphus of instar I, dorsal. A - *Agabus elongatus*. B - *A. wasastjernae*. C - *A. phaeopterus*. D - *Ilybius vittiger*. E - *Agabinus glabrellus*. F - *Colymbetes paykulli*. G - *Rhantus binotatus*. H - *Rhantus grapei*. I - *Neoscutopterus hornii*. J - *Matus bicarinatus*. Drawn to different scales.

subequal in size; **antenna:** uniramous or biramous, distinctly shorter to or slightly longer than head length; A1 to A3 not secondarily subdivided; A4 distinctly shorter to or slightly longer than A3; **mandible:** channelled, broad and sharply falcate, not curved upward apically, inner margin smooth or serrated on distal half, with a tuft of small hairs present or not; **maxilla:** with cardo reduced, subovate to subrectangular; maxillary stipes fairly broad or narrow and elongate, with inner margin setose proximad to galea and with small hook-like structures present or not basally; galea 1-segmented, finger-like; palpifer well-developed, similar to a palpomere; MX1 to MX3 not secondarily subdivided, MX3 subequal to or distinctly longer than MX2; **labium:** with prementum subtrapezoidal or subrectangular (broader than long); anterior margin of prementum straight to concave medially; ligula absent; LB1 and LB2 not secondarily subdivided, LB2 subequal to or slightly longer than LB1.

Thorax. Legs: without natatory setae; pro- and mesothoracic legs pseudo-chelate or not; tarsal claw with basoventral spinulae present or absent.

Abdomen. LLAS = 0.25–1.63 mm; urogomphus L = 0.61–2.11 mm; lacking lateral tracheal gills, fully sclerotized dorsally, membranous ventrally, except segment 7, partly to fully sclerotized and segment 8 fully sclerotized; segments 7 and 8 lacking a fringe of natatory setae laterally; segment 8 with additional setae absent or present, slender, more or less elongate, feebly conical to subconical, with lateral margins straight to slightly concave, either evenly converging from base to apex of siphon or subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon usually short, triangular or subtriangular in outline with lateral margin slightly sinuate or not, bluntly pointed apically; urogomphus 1- or 2-segmented, with a subbasal suture present or not, about 0.50–5.26x LLAS; where present, urogomphomere 2 distinctly shorter than urogomphomere 1; urogomphus with additonal setae absent or present; where absent, primary setae UR2, UR3, and UR4 variously positioned on urogomphomere 1; primary seta UR8 inserted subapically on urogomphomere 1.

Instar II. As instar I except for the following characters:
Head. Head length = 0.91 – 2.69 mm; head width = 0.87 – 2.58 mm; head length: head width = 0.94–1.44; **head capsule:** temporal angles distinct (i.e., lateral margin more strongly constricted posteriorly at level of cervical region); parietals with a variable number of temporal spines anterad to cervical constriction; egg bursters absent; **antenna** subqual to or shorter than head length; **maxilla**, MX3 slightly shorter to or longer than MX2; **labium**, LB2 shorter to or slightly longer than LB1.

Thorax. Legs with natatory setae present or absent; where present, natatory setae located in a single row on posterodorsal margin of tarsus, of tibia and tarsus, or of femur, tibia and tarsus.

Abdomen. LLAS = 0.55–2.06 mm; urogomphus L = 0.62–2.98 mm; siphon relatively shorter than in instar I; segments 7 and 8 ventrally completely sclerotized; urogomphus about 0.40–2.50x LLAS, with secondary setae absent or present.

Instar III. As for instar II except for the following characters:
Head. Head length = 1.20 – 3.92 mm; head width = 1.20 – 3.77 mm; head length: head width = 0.86 – 1.36.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 0.92–3.30 mm; urogomphus L = 0.55–4.13.mm; segments 1 to 7 each with a pair of spiracles on pleural region; segment 6 ventrally membranous or completely sclerotized; urogomphus about 0.30–2.00x LLAS.

Comments. See under Laccophilinae

Key to genera of Colymbetinae of North America
Key to Instar I

1. Pro- and mesothoracic legs pseudo-chelate (Fig. 221C); antenna biramous (Fig. 214F) .... *Matus* Aubé, p. 910

1'. Pro- and mesothoracic legs not pseudo-chelate; antenna uniramous (Fig. 214A – D, G, H) or biramous 2

2(1). Tarsal claw smooth, lacking basoventral spinulae; head with occipital suture absent (Figs. 218A; 219A) 5

2'. Tarsal claw with basoventral spinulae (Fig. 216); head with occipital suture present (Fig. 220A, C) 3

3(2). Abdomen segment 7 with ventral surface sclerotized; urogomphus and abdomen segment 8 with numerous additional setae in addition to the primary setae (Fig. 217I, 220F); prementum with anterior margin deeply emarginate; antenna distinctly shorter than head length; larger size .... *Neoscutopterus* Balfour-Browne, p. 909

3'. Abdomen segment 7 with ventral surface membranous; urogomphus and abdomen segment 8 with the primary setae only (Figs. 217A – H; 220D, E); prementum with anterior margin straight or slightly concave; antenna fairly long, subequal to or longer than head length 4

4(3). Apex of meso- and metafemur with two elongate and hair-like setae on posterior surface (Fig. 215H); abdomen segment 8 elongate, more than 0.70 times as long as head width; smaller species, head length 1.10 mm .... *Rhantus* Dejean, p. 905

4'. Apex of meso- and metafemur with one elongate and hair-like seta on posterior surface (Fig. 215L); abdomen segment 8 shorter, at most 0.60 times as long as head width; larger species, head length > 1.10 mm .... *Colymbetes* Clairville, p. 908

5(2). Urogomphus 1-segmented (Fig. 217E); antenna biramous .... *Agabinus* Crotch, p. 903

5'. Urogomphus 2-segmented (Fig. 217A – D); antenna uniramous (Fig. 214A – D), at most with a small bulge on antennomere 3 6

6(5). Urogomphus with basal articulation of primary seta UR4 distinctly separated from base of seta UR3 (Fig. 214B, C) .. *Agabus* Leach, in part, p. 898

6'. Urogomphus with basal articulations of primary setae UR4 and UR3 contiguous (Fig. 217A, D) 7

7(6). Abdomen segment 8 shorter, less than 0.70 times as long as head width 8

7'. Abdomen segment 8 more elongate, more than 0.80 times as long as head width .... *Ilybius* Erichson, in part, p. 902

8(7). Femur with 1 dorsal spine which is located in proximal half (Fig. 215E) .... *Agabus* Leach, in part, p. 898

8'. Femur with 1 dorsal spine which is located at middle of length or distally (Fig. 215C) .... *Ilybius* Erichson, in part, p. 902

Key to Instar II and III

1. Pro- and mesothoracic legs pseudo-chelate (Fig. 221C); antenna biramous (Fig. 214F) .... *Matus* Aubé, p. 910

1'. Pro- and mesothoracic legs not pseudo-chelate; antenna uniramous (Fig.) or biramous (Fig. 214A – D, G, H) 2

2(1). Urogomphus with a subbasal suture and secondary setae present (Fig. 220G, H); occipital suture present (Fig. 220A, C); legs with natatory setae present on dorsal margin either of femur, tiba and tarsus or of tarsus only 3

2'. Urogomphus with subbasal suture absent and secondary setae present or absent (usually absent) (Fig. 218C); occipital suture absent (Fig. 218A); legs with natatory setae absent or present, if present restricted to dorsal margin of tibia and tarsus 6

3(2). Tibia and femur lacking natatory setae; tarsal claw lacking basoventral spinulae or at most feebly developed (Fig. 216J); prementum with anterior margin deeply emarginate 4

4(3). Labial palpomere I shorter than maxillary stipes; eastern USA .... *Hoperius* Fall [known only as mature larva; not treated further]

4'. Labial palpomere I longer than maxillary stipes; Canada and boreal United .... *Neoscutopterus* Balfour-Browne, p. 909

4". Tibia and femur with natatory setae; tarsal claw with basoventral spinulae (Fig. 216B, F); prementum with anterior margin straight or at most slightly concave 5

5(4). Abdomen segment 8 elongate, subequal to or longer than head width; smaller species, head width 1.70 mm (instar II) and 2.60 mm (instar III) .... *Rhantus* Dejean, p. 905

5'. Abdomen segment 8 shorter, less than 0.90 times as long as head width; larger species, head width about 1.90 mm (instar II) and 2.70 mm (instar III) .... *Colymbetes* Clairville, p. 908

6(2). Urogomphus 1-segmented (Fig. 217E); antenna biramous; maxillary stipes with hook-like structures absent .... *Agabinus* Crotch, p. 903

6'. Urogomphus 2-segmented (Fig. 217A – D); antenna uniramous (Fig. 214A – D); maxillary stipes with 2 hook-like structures (Fig. 214R) . . .7

7(6). Tibia and tarsus with natatory setae or, if lacking, abdomen segment 6 fully sclerotized ventrally (ventral plate may be lacking in instar II) .... *Agabus* Leach, in part, p. 898

7'. Tibia and tarsus lacking natatory setae and abdomen segment 6 membranous ventrally 8

8(7). Urogomphus with secondary setae absent (Fig. 218C) 10

8'. Urogomphi with secondary setae present (Fig. 220G, H) 9

9(8). Abdomen segment 8 elongate, more than 0.80 times as long as head width .... *Ilybius* Erichson, in part, p. 902

9'. Abdomen segment 8 shorter, less than 0.60 times as long as head width .... *Agabus* Leach, in part, p. 898

10(8). Urogomphus with basal articulations of primary setae UR2, UR3, and UR4 contiguous (Fig. 217A) 11

10'. Urogomphus with primary setae UR2, UR3, and UR4 distinctly separated (Fig. 217C) .... *Agabus* Leach, in part, p. 898

11(10). Head capsule with lateral margin usually compressed in an horizontal keel; temporal spines usually positioned parallel to the horizontal keel .... *Ilybius* Erichson, in part, p. 902

11'. Head capsule with lateral margin not compressed in a keel; temporal spines usually positioned in an oblique line running well below ocular area .... *Agabus* Leach, in part, p. 898

Genus *Agabus* Leach

Figs. 214A, B, I, L, M, R, S; 215E, F; 217A, B, C; 218; 232

Diagnosis. Head capsule with occipital suture absent in instar I, present or absent in instar II and II; antenna uniramous; maxillary stipes broad, with two short spine-like structures on inner margin; prementum with anterior margin straight or only slightly emarginate; pro- and mesothoracic legs not pseudo-chelate; tarsal claws lacking basoventral spinulae; legs with natatory setae absent or present; abdomen segment 7 with ventral surface membranous or, at most, with two incompletely fused sclerites in instar I; abdomen segment 8 with only primary setae in instar I; urogomphus more or less elongate, shorter to or distinctly longer than LLAS in instar III, 2-segmented, with 8 primary setae setae in instar I, with secondary setae present or absent and subbasal suture absent in instar II and III.

Instar I (Figs. 214A, B, I, L, M, R, S; 215E, F; 217A, B, C; 218D, E).

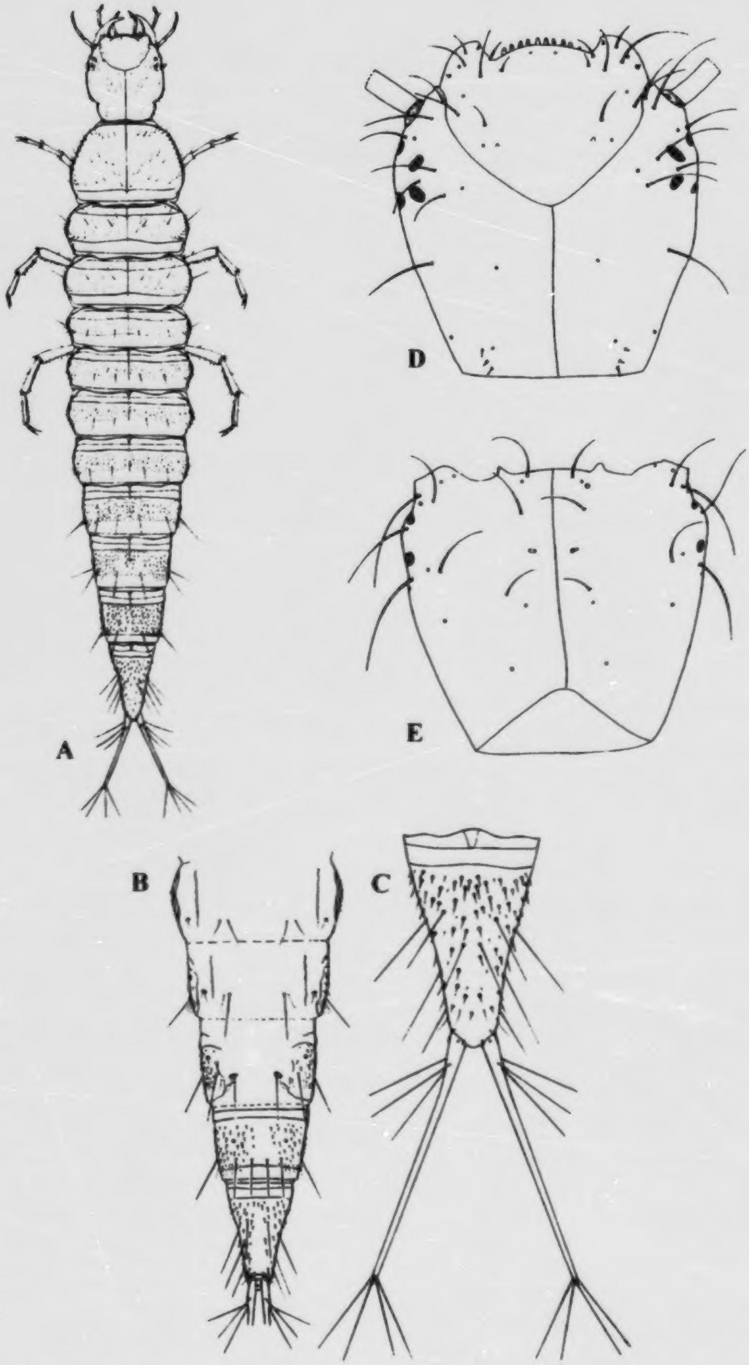

Fig. 218. Colymbetinae, *Agabus*. A – C - *A. bipustulatus*, instar III (from De Marzo 1973). A - habitus. B - abdominal segments IV - VIII, ventral. C - last abdominal segment with urogomphi, dorsal. D – E - *A. anthracinus*, head capsule instar I, D - dorsal, E - ventral. Drawn to different scales.

Head (Figs. 214A, B, I, L, M, R, S; 218D, E). Head length = 0.70 – 1.28 mm; head width = 0.65 – 1.11 mm; head length: head width = 0.98 – 1.39; **head capsule** (Fig. 218D, E): of various shape, triangular or subtriangular with lateral margin strongly diverging anteriorly, trapezoidal with lateral margin slightly to strongly divergent anteriorly, subquadrangular (or subrectangular) with parallel or subparallel sides, or rounded; subequal to or longer than broad; cervical region well-delimited or not, temporal angle well-marked or not (i.e. lateral margin distinctly constricted or not posteriorly); occipital suture absent; frontoclypeus with anterior margin at most slightly arcuate, with a lateral lobe on each side, with club-shaped to spine-like clypeolabral setae; **antenna** (Fig. 214A, B): uniramous, subequal to or distinctly shorter than head length; A4 distinctly shorter than A3; **mandible** (Fig. 214I): inner margin smooth, minutely serrated or distinctly toothed on distal half, with a tuft of small hairs on basal half; **maxilla** (Fig. 214R, S): stipes broad, with inner margin setose proximad to galea and with two small hook-like structures basally; galea 1-segmented and finger-like; MX3 subequal to or distinctly longer than MX2; **labium** (Fig. 214L, M): with prementum subrectangular, anterior margin straight to slightly concave; LB2 subequal to or distinctly longer than LB1.

Thorax. Legs (Fig. 215E, F): pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen (Fig. 217A – C). LLAS = 0.30 – 0.58 mm; urogomphus L = 0.66 – 1.70 mm; segment 7 partly sclerotized or not ventrally; segment 8 with only primary setae; slender, more or less elongate, feebly conical; lateral margin straight to slightly concave, subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon usually short, triangular or subtriangular in outline with lateral margin slightly sinuate or not, apex more or less acute; urogomphus 2-segmented, without subbasal suture, about 1.50 – 5.26x LLAS, with only primary setae; setae UR2, UR3, and UR4 variously positioned on urogomphomere 1 (Fig 217A – C): contiguous, equidistant in position, UR2 basal and not contiguous with UR3 and UR4, or UR4 median in position and not contiguous with UR2 and UR3.

Instar II. As instar I except for the following characters:
Head. Head length = 1.04 – 1.82 mm; head width = 0.97 – 1.62 mm; head length: head width = 1.07–1.44; **head capsule**, occipital suture present or absent; **antenna** shorter than head length; **maxilla**, MX3 longer than MX2; **labium**, LB2 longer than LB1.

Thorax. Legs with or without natatory setae, where present, natatory setae located in a single row on posterodorsal margin of tibiae and tarsi.

Abdomen. LLAS = 0.64–1.30 mm; urogomphus L = 0.88–2.40 mm; urogomphus about 1.00–2.50x LLAS, with secondary setae absent (except *A. confusus* in which instar III possesses secondary setae on urogomphus); urogomphomere 2 visible but always very short.

Instar III (Figs. 218A – C; 232). As for instar II except for the following characters:
Head. Head length = 1.30 – 2.60 mm; head width = 1.20 – 2.33 mm; head length: head width = 1.02–1.36; **maxilla**, MX3 subequal to or distinctly shorter than MX2; **labium**, LB2 shorter than to longer than LB1.

Abdomen. LLAS = 0.98-2.18 mm; urogomphus L = 0.55–2.92 mm; segment 6 ventrally completely sclerotized or not; urogomphus about 0.40–2.00x LLAS; urogomphomere 2 present but very short and sometimes very difficult to see.

Comments. The larvae of *Agabus* and *Ilybius* are unique among the known species of Colymbetinae of Canada and Alaska in possessing 2-segmented urogomphi and two short, spine-like structures medially on the inner margin of the maxillary stipes. Both genera are closely related to *Agabinus* as suggested recently by Alarie (1995*b*; 1998) and Alarie and Larson (1998). Larvae of *Agabinus* are readily distinguished from those of *Agabus* and *Ilybius* by the presence of a biramous antenna and a one-segmented urogomphus. The separation of *Agabus* and *Ilybius* larvae is however difficult, especially for instar I.

Instar I of many species of *Agabus* and *Ilybius* possess one dorsal seta on each femur. Nilsson (1987) proposed that *Agabus* larvae are distinguishable from those of *Ilybius* by a more proximal position of the seta. The relative length of abdomen segment 8 separates instar I of many species of *Agabus* and *Ilybius*. Generally, segment 8 is less elongate within *Agabus* (usually less than 0.6x head width) than within *Ilybius* (usually much more than 0.6x head width). The relative position of the primary setae UR2, UR3, UR4 on urogomphomere 1 is useful for the recognition of some species. In *Ilybius*, the basal articulations of UR2, UR3, and UR4 are either contiguous and proximal on urogomphomere 1 or subdivided into two groups, UR2 proximally, and UR3 and UR4 contiguous but more medially positioned. Such character states are also found in many species of *Agabus* but others have UR2, UR3, and UR4 about equidistant in position or UR2 and UR3 contiguous basally and UR4 positioned more medially.

The usual diagnostic features given for separating instar II and III of *Agabus* and *Ilybius* are the arrangement of the temporal spines and the presence/absence of a longitudinal ridge along each side of the head capsule. In many species of *Agabus*, temporal spines are positioned in an oblique line running well below the ocular area and the lateral margin of the head capsule is not compressed to form a sort of keel, although in *A. seriatus* the head is keeled laterally. In *Ilybius*, the lateral margin of the head capsule is compressed to form an horizontal ridge extending through the stemmata, or just below them, to the base of the antenna and temporal spines are parallel to this horizontal ridge. However, these character states do not separate all larvae of *Agabus* and *Ilybius* because the lateral ridge is weak in some species of *Ilybius* (such as *I. angustior)* and, thus, no difference can be seen in this character.

Of the 58 species known worldwide as instar II and III, six species (the Nearctic *A. aeruginosus*, *A. punctatus*, and *A. antennatus* and the Palearctic *A. labiatus* (Brahm), *A. serricornis* (Paykull), and *A. undulatus* (Schrank)) are characterized by the presence of natatory setae on tibiae and tarsi. Three others species (the Nearctic *A. ambiguus* and *A. disintegratus* and the Palearctic *A. setulosus* (J. Sahlberg)) have the abdomen segment 6 completely sclerotized ventrally. Natatory setae are lacking and abdominal segment 6 is always membranous ventrally among the known larvae of *Ilybius*. Similarly, of the 11 species of *Ilybius* known worldwide, three species (the Palearctic *I. aenescens* Thomson, *I. fenestratus* (Fabricius), and *I. fuliginosus* (Fabricius)) have secondary setae on the urogomphus, a feature reported for five species of *Agabus* (the Nearctic *A. confusus* (Blatchley) (Hilsenhoff 1974) and the Afrotropical *A. perssoni* Nilsson, *A. crypticoides* Régimbart, *A. abessinicus* (Zimmermann), and *A. galamensis* Nilsson (Nilsson 1992)).

The larvae of 16 North American species of *Agabus* have been described: *A. aeruginosus*, *A. ambiguus*, *A. antennatus* (as *A. clavatus* LeConte), *A. bifarius*, *A. confusus*, *A. discolor*, *A. disintegratus*, *A. erichsoni*, *A. erythropterus*, *A. fuscipennis* (as *A. ontarionis* Fall), *A. obtusatus*, *A. phaeopterus*, *A. punctatus*, *A. semivittatus*, *A. seriatus*, and *A. staginus* (James 1969; Watts 1970; Barman 1972; Hilsenhoff 1974;

Matta 1986). In additon to these species, the larvae of the Holarctic *A. arcticus*, *A. confinis*, *A. elongatus*, *A. opacus*, *A. wasastjernae*, and *A. zetterstedti* are known from European material (Galewski 1980; Nilsson 1980, 1982, 1985*a*, 1985*b)*.

See also under *Hydrotrupes*.

Genus *Ilybius* Erichson

Figs. 214C, D; 215C, D; 217D; 233A

Diagnosis. Head capsule with occipital suture absent in instar I, present or absent in instar II and II; antenna uniramous; maxillary stipes broad, with two short spine-like structures on inner margin; prementum with anterior margin straight or only slightly emarginate; pro- and mesothoracic legs not pseudo-chelate; tarsal claws lacking basoventral spinulae; legs with natatory setae absent; abdomen segment 7 with ventral surface membranous in instar I; abdomen segment 8 with only primary setae in instar I; urogomphus more or less elongate, shorter to or distinctly longer than LLAS in instar III, 2-segmented, with 8 primary setae in instar I, with secondary setae present or absent, and subbasal suture absent in instar II and III.

Instar I (Figs. 214C, D; 215C, D; 217D)
Head. Head length = 0.84 – 1.32 mm; head width = 0.72 – 1.28 mm; head length: head width = 1.03 – 1.25; **head capsule:** rounded to subquadrangular (or subrectangular) in outline with lateral margins subparallel to distinctly diverging anteriorly, subequal to or slightly longer than broad; cervical region well-delimited or not, temporal angles slightly to distinctly marked (i.e., lateral margins distinctly constricted or not posteriorly); occipital suture absent; frontoclypeus with anterior margin slightly to distinctly arcuate anteriorly, with a lateral lobe on each side, with club-shaped clypeolabral setae; **antenna** (Fig. 214C, D): uniramous, distinctly shorter than head length; A4 distinctly shorter than A3; **mandible:** inner margin smooth, neither toothed or minutely serrated, with a tuft of small hairs on basal half; **maxilla:** stipes broad, with inner margin lightly setose proximad to galea with two small hook-like structures basally; galea 1-segmented; MX3 slightly shorter to distinctly longer than MX2; **labium:** with prementum subrectangular, anterior margin straight to sligthly concave; LB2 subequal to or distinctly shorter than LB1.

Thorax. Legs (Fig. 215C, D): pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen (Fig. 217D). LLAS = 0.44–1.45 mm; urogomphus L = 0.90–1.83 mm; segment 7 membranous ventrally; segment 8 with only primary setae, slender, elongate, feebly to distinctly conical, lateral margins subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon more or less elongate, subtriangular in outline, with lateral margins straight to slightly sinuate, apex rounded to acute; urogomphus 2-segmented (Fig. 217D), without subbasal suture, about 1.00–2.80x LLAS, with only primary setae; setae UR2, UR3 and UR4 variously positioned on urogomphomere 1: either contiguous or UR2 more basal and not contiguous to UR3 and UR4.

Instar II. As instar I except for the following characters:
Head. Head length = 1.16 – 1.94 mm; head width = 1.00 – 1.72 mm; head length: head width = 1.07 – 1.19; **head capsule:** occipital suture absent or only feebly delimited;

antenna shorter than head length; **maxilla:** MX3 subequal to or slightly longer than MX2; **labium:** LB2 shorter than to slightly longer than LB1.

Thorax. Legs with natatory setae absent.

Abdomen. LLAS = 0.80–2.06 mm; urogomphus L = 1.30–2.72 mm; urogomphus about 0.90–2.40x LLAS, with secondary setae absent or present; urogomphomere 2 visible but always very short.

Instar III (Fig. 233A). As for instar II except for the following characters:
Head. Head length = 1.60 – 2.77 mm; head width = 1.44 – 2.53 mm; head length: head width = 1.01 – 1.20; **maxilla:** MX3 slightly shorter to slightly longer than MX2; **labium:** LB2 subequal to or distinctly shorter than LB1.

Abdomen. LLAS = 1.36–2.90 mm; urogomphus L = 1.60–3.50 mm; abdomen segment 6 membranous ventrally; urogomphus about 0.80–1.90x LLAS; urogomphomere 2 present but very short and sometimes difficult to see.

Comments. At the moment, the larvae of no Nearctic species of *Ilybius* has been described. The larvae of the Holarctic *I. angustior*, *I. subaeneus*, and *I. vittiger* are known from European material (Bertrand 1928; Galewski 1966: Nilsson 1981, 1983).

See under *Agabus*.

Genus *Agabinus* Crotch

Figs. 215A, B; 217E; 219; 233B

Diagnosis. Head capsule with occipital suture absent; antenna biramous; maxillary stipes broad, without short spine-like structures on inner margin; prementum with anterior margin sligltly emarginate; pro- and mesothoracic legs not pseudo-chelate; tarsal claws lacking basoventral spinulae; legs with natatory setae absent; abdomen segment 7 with ventral surface membranous in instar I; abdomen segment 8 with only primary setae in instar 1; urogomphus more or less elongate, distinctly longer than LLAS in instar III, 1-segmented, with 8 primary setae in instar I , with secondary setae and subbasal suture absent in instar II and III.

Instar I (Figs. 215A, B; 217E; 219A–D)
Head. Head length = 0.59 – 0.63 mm; head width = 0.61 – 0.62 mm; head length: head width = 0.95 – 1.02; **head capsule** (Fig. 219A, B): rounded to subquadrangular in outline with lateral margin slightly diverging posteriorly, about as long as broad; cervical region well-delimited, temporal angles distinctly marked (i.e., lateral margins distinctly constricted posteriorly); occipital suture absent; frontoclypeus with anterior margin arcuate anteriorly with a lateral lobe on each side, with club-shaped clypeolabral setae; **antenna:** biramous, distinctly shorter than head length; A4 subequal to A3 in length; **mandible:** inner margin shortly serrated, with a tuft of small hairs on basal half; **maxilla:** stipes broad, with inner margin lightly setose proximad to galea, without hook-like structures basally; galea 1-segmented; MX3 distinctly longer than MX2; **labium:** with prementum subrectangular, anterior margin concave; LB2 subequal to LB1 in length.

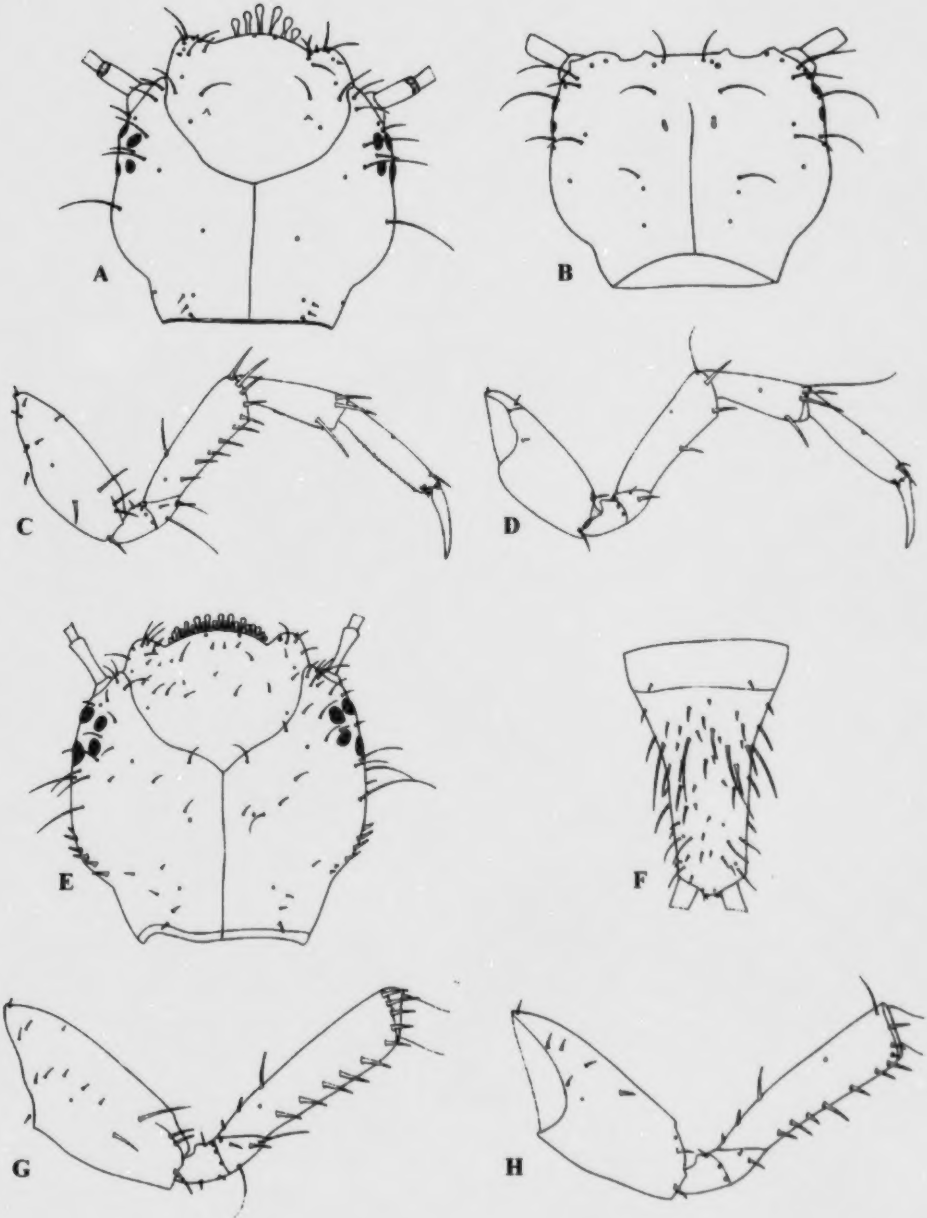

Fig. 219. Colymbetinae, *Agabinus* Crotch. A – D - instar I. A - B - head capsule, A - dorsal, B - ventral. C - D - metathoracic leg, C - anterior, D - posterior. E – H - instar III. E - head capsule, dorsal. F - last abdominal segment, dorsal. G - H - metathoracic leg, G - anterior, H - posterior. Drawn to different scales.

Thorax. Legs (Figs. 215A, B; 219C, D): pro- and mesothoracic legs not pseudo-chelate; tarsal claws lacking basoventral spinulae.

Abdomen (Fig. 217E). LLAS = 0.25–0.29 mm; urogomphus L = 0.71–0.74 mm; segment 7 membranous ventrally; segment 8 with only primary setae, subquadrate, lateral margins straight, subparallel from base to point of insertion of urogomphi, abruptly converging thereafter; siphon short, subtriangular in outline, with lateral margins slightly sinuate, apex rounded and sinuate; urogomphus 1-segmented (Fig. 217E), without subbasal suture, 2.55–3.00x LLAS, with only primary setae; basal articulations of setae UR2, UR3 and UR4 contiguous.

Instar II. As instar I except for the following characters:
Head. Head length = 0.90 – 0.91 mm; head width = 0.87 – 0.89 mm; head length: head width = 0.95 – 1.05 **head capsule:** occipital suture absent; **antenna** shorter than head length; **maxilla:** MX3 longer than MX2; **labium:** LB2 slightly shorter than LB1.

Thorax. Legs with natatory setae absent.

Abdomen. LLAS = 0.50–0.54 mm; urogomphus L = 1.01–1.05 mm; urogomphus about 1.89–2.04x LLAS, with secondary setae absent.

Instar III (Figs. 219E – H; 233B). As for instar II except for the following characters:
Head (Fig. 219E – F). Head length = 1.32 – 1.35 mm; head width = 1.25 – 1.33 mm; head length: head width = 1.02–1.06; **maxilla:** MX3 subequal to MX2 in length; **labium:** LB2 distinctly shorter than LB1.

Abdomen. LLAS = 0.92-1.10 mm; urogomphus L = 1.29–1.33 mm; urogomphus about 1.20–1.40x LLAS.

Comments. The larvae of *Agabinus glabrellus*, one of the two North American species of *Agabinus*, have been described recently (Alarie and Larson 1998).

See under *Agabus*.

Genus *Rhantus* Dejean

Figs. 214G, H, J; 215G, H; 216A – D; 217G, H; 220A, B, E, G; 234A

Diagnosis. Head capsule with occipital suture always present; antenna uniramous; maxillary stipes broad, without short spine-like structures on inner margin; prementum with anterior margin straight or only slightly emarginate; pro- and mesothoracic legs not pseudo-chelate; tarsal claws with basoventral spinulae present; legs with natatory setae present; abdomen segment 7 with ventral surface membranous in instar I; abdomen segment 8 with only primary setae in instar I; urogomphus more or less elongate, slightly shorter to or slightly longer than LLAS in instar III, 1-segmented, with 8 primary setae in instar I, with secondary setae and subbasal suture present in instar II and III.

Instar I (Figs. 214G, H, J; 215G, H; 216A – D; 217G, H; 220A, B, E).
Head (Figs. 214G, H, J; 220A, B). Head length = 0.61 – 1.27 mm; head width = 0.68 – 1.05 mm; head length: head width = 0.90 – 1.20; **head capsule** (Fig. 220A, B): rounded to subtrapezoidal in outline with lateral margin usually strongly diverging anteriorly, as long as to slightly longer than broad; cervical region well-delimited, temporal angle distinct; occipital suture present; frontoclypeus with anterior margin distinctly arcuate , with a lateral lobe on each side, with club-shaped clypeolabral setae; **antenna** (Fig.

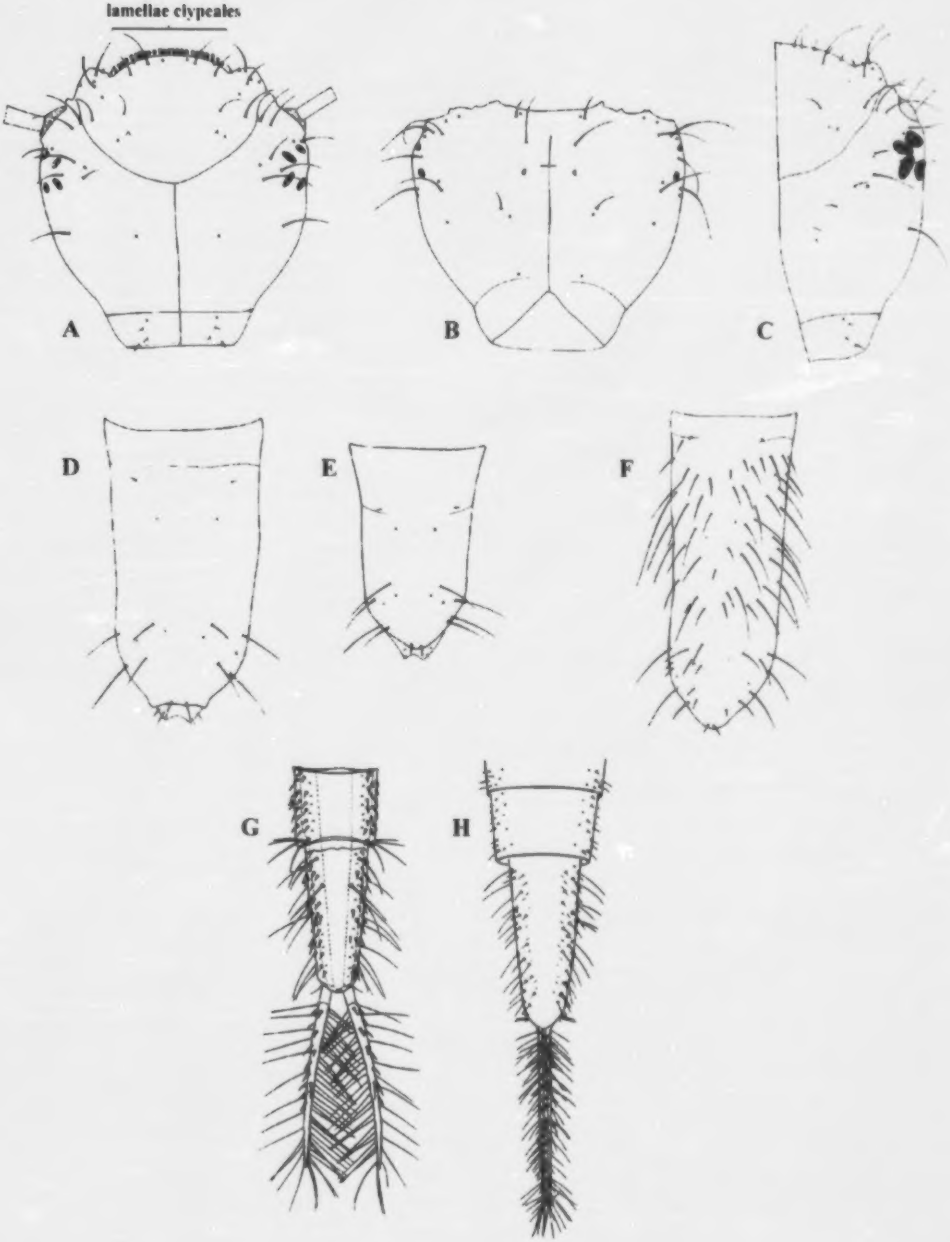

Fig. 220. Colymbetinae, Colymbetini. A – C - head capsule, instar I. A - B - *Rhantus wallisi*, A - dorsal, B - ventral. C - *Neoscutopterus hornii*, right side, dorsal. D - H - last abdominal segment dorsal, D – F - instar I. D - *Colymbetes paykulli*. E - *Rhantus binotatus*. F - *Neoscutopterus hornii*. G – H - instar III. G - *Rhantus binotatus*. H - *Colymbetes sculptilis*. (G - H after James 1970). Drawn to different scales.

214G, H): uniramous, slightly shorter to or slightly longer than head length; A4 subequal to slightly longer than A3; **mandible** (Fig. 214J): inner margin smooth, neither toothed or serrated, usually with a tuft of short hairs medially; **maxilla:** stipes broad, with inner margin lightly setose, without hook-like structures basally; galea 1-segmented; MX3 slightly longer than MX2; **labium** with prementum subrectangular, anterior margin straight to slightly concave; LB2 subequal in length to LB1.

Thorax. Legs (Figs. 215G, H; 216A – D), pro- and mesothoracic legs not pseudochelate; tarsal claw with basoventral spinulae present.

Abdomen (Figs. 217G, H; 220E). LLAS = 0.62–0.99 mm; urogomphus L = 0.94–1.70 mm; segment 7 membranous ventrally; segment 8 (Fig. 220E) with only primary setae, fairly elongate, subconical, lateral margin straight to slightly concave, subparallel to slightly converging from base to point of insertion of urogomphus, abruptly converging thereafter; siphon very short, subtriangular in outline with apex distinctly sinuate apically; urogomphus (Fig. 217G, H) 1-segmented, with subbasal suture absent, about 1.10–2.10x LLAS, with only primary setae present; basal articulations of setae UR2, UR3, and UR4 about equidistant from one another in position.

Instar II. As instar I except for the following characters:

Head. Head length = 1.13 – 1.87 mm; head width = 1.11 – 1.68 mm; head length: head width = 1.02 – 1.16; **head capsule:** occipital suture present; **antenna** subequal to slightly shorter than head length; A4 subequal to A3 in length; **maxilla:** MX3 slightly shorter than MX2; **labium:** LB2 shorter than LB1.

Thorax. Legs with natatory setae, located in a single row on posterodorsal margin of femora, tibiae, and tarsi.

Abdomen. LLAS = 1.45–1.70 mm; urogomphus L = 1.52–2.52 mm; segment 8 subtruncate apically; siphon very short; urogomphus with subbasal suture present, about 0.90–1.70x LLAS, with secondary setae (Fig. 220G).

Instar III (Fig. 220G, 234A). As for instar II except for the following characters:

Head. Head length = 1.91 – 2.85 mm; head width = 1.70 – 2.63 mm; head length: head width = 1.08 – 1.31; **antenna** distinctly to slightly shorter than head length; **maxilla:** MX3 shorter than MX2; **labium:** LB2 shorter than LB1.

Abdomen (Fig. 220G). LLAS = 2.30–3.30 mm; urogomphus L = 2.04–3.52 mm; urogomphus about 0.70–1.20x LLAS.

Comments. The larvae of *Rhantus* are easy to separate from those of other genera of Colymbetinae except the larvae of *Colymbetes* (see also comments under *Neoscutopterus*). Both these genera are characterized by elongate head appendages (antenna subequal to or slightly shorter than head length in instar III), presence of numerous ventrobasal spinulae on tarsal claws, presence of numerous natatory setae located in a single row on dorsal margin of femora, tibiae and tarsi, and presence of secondary setae on urogomphus of instar II and III larvae (the last two character states are known to occur in larvae of *Matus* but setae are less numerous).

The similarity between the larvae of *Rhantus* and *Colymbetes* is striking. However, *Rhantus* is distinguished by its smaller size, a slightly narrower head capsule, and a slightly longer abdominal segment 8. The ratio of LLAS: head width is diagnostic particularly for the recognition of instar I of these two genera. Also, larvae of *Rhantus* are characterized by the presence of two elongate, hair-like setae on posterior surface of meso- and metafemur instead of only one in *Colymbetes* (Alarie 1995*b*). Instar II and III larvae of *Rhantus* and *Colymbetes* can be distinguished by the number of secondary setae present on the dorso-posterior margin of the metafemur. Instar II and III larvae of *Rhantus* have less than 8 and 15 setae respectively instead of more than 15 and 30 setae in *Colymbetes*.

In North America, the mature larva of the Nearctic species *R. binotatus* and *R. consimilis* (James 1969; Watts 1970; Barman 1972) have been described. The larvae of *R. suturellus* was described from European material (Galewski 1963). Hilksenhoff (1993*b*) described several characters that may be useful for distinguishing larvae of several species but did not provide a key for he could not find characters by which all Wisconsin species could be identified.

Genus *Colymbetes* Clairville
Figs. 215K, L; 216E – H; 217F; 220D, H; 234B

Diagnosis. Head capsule with occipital suture always present; antenna uniramous; maxillary stipes broad, without short spine-like structures on inner margin; prementum with anterior margin straight or only slightly emarginate; pro- and mesothoracic legs not pseudo-chelate; tarsal claws with basoventral spinulae present; legs with natatory setae present; abdomen segment 7 with ventral surface membranous in instar I; abdomen segment 8 with only primary setae in instar I; urogomphus more or less elongate, subequal to distinctly longer than LLAS in instar III, 1-segmented, with 8 primary setae in instar I, with secondary setae and subbasal suture present in instar II and III.

Instar I (Figs. 215K, L; 216E – H; 217F; 220D)
Head. Head length = 1.14 – 1.61 mm; head width = 1.12 – 1.57 mm; head length: head width = 1.01 – 1.06; **head capsule:** rounded to subtriangular in outline with lateral margins slightly to strongly diverging anteriorly, cervical region well-delimited, temporal angle distinct; occipital suture present; anterior margin of frontoclypeus distinctly arcuate with a lateral lobe on each side, with clypeolabral setae either long and apically rounded or short and bifurcate; **antenna:** uniramous, subequal in length to head length; A4 subequal to slightly longer than A3; **mandible:** inner margin smooth, neither toothed or serrated, with a small tuft of short hairs medially; **maxilla:** stipes broad, with inner margin not setose except for short and sparse setae, and without hook-like structures basally; galea 1-segmented; MX3 slightly longer than MX2; **labium:** with prementum subrectangular, anterior margin straight to slightly concave; LB2 subequal in length to LB1.

Thorax. Legs (Figs. 215K, L; 216E – H): pro- and mesothoracic legs not pseudo-chelate; tarsal claw with basoventral spinulae present.

Abdomen (Figs. 217F; 220D). LLAS = 0.61–0.84 mm; urogomphus L = 1.62–2.11 mm; segment 7 membranous ventrally; segment 8 (Fig. 220D) with only primary setae, more or less elongate, subconical, with straight to slightly concave sides, lateral margins subparallel to slightly converging from base to point of insertion of urogomphus, abruptly converging thereafter; siphon very short, subtriangular in outline with apex distinctly sinuate apically; urogomphus (Fig. 217F) 1-segmented, with subbasal suture absent, about 1.7–3.0x as long as LLAS, with only primary setae present; basal articulations of setae UR2, UR3, and UR4 about equidistant from one another.

Instar II. As instar I except for the following characters:
Head. Head length = 1.96 – 2.59 mm; head width = 1.90 – 2.58 mm; head length: head width = 1.01 – 1.08; **head capsule:** occipital suture present, **mandible** with a distinct bulge on inner margin present or not; **antenna** slightly shorter than head length; **maxilla:** MX3 slightly shorter than MX2; **labium:** LB2 shorter than LB1.

Thorax. Legs with natatory setae located in a single row on the posterodorsal margin of femora, tibiae, and tarsi.

Abdomen. LLAS = 1.28–1.93 mm; urogomphus L = 2.37–2.98 mm; segment 8 subtruncate apically, siphon very short; urogomphus with subbasal suture present, about 1.30–2.20x LLAS, with secondary setae (Fig. 220G).

Instar III (Fig. 220H, 234B). As for instar II except for the following characters:
Head. Head length = 2.78 – 3.92 mm; head width = 2.69 – 3.77 mm; head length: head width = 1.02 – 1.07; **antenna** distinctly shorter than head length; A4 slightly shorter than A3; **maxilla:** MX3 slightly to distinctly shorter than MX2.

Abdomen (Fig. 220H). LLAS = 2.19–3.14 mm; urogomphus L = 3.13–4.13 mm; urogomphus about 1.00–1.5x LLAS.

Comments. In North America, the larvae of the Nearctic species *C. sculptilis* have been described (James 1969; Watts 1970). The larvae of *C. dolabratus* and *C. paykulli* have been described from European material (Galewski 1964, 1968)
See under *Rhantus*.

Genus *Neoscutopterus* Balfour-Browne

Figs. 215I, J; 216I – L; 217I; 220C, F

Diagnosis. Head capsule with occipital suture always present; antenna uniramous; maxillary stipes broad, without short spine-like structures on inner margin; prementum with anterior margin deeply emarginate; pro- and mesothoracic legs not pseudo-chelate; tarsal claws with basoventral spinulae present but weakly developed; legs with natatory setae present; abdomen segment 7 fully sclerotized in instar I; abdomen segment 8 with numerous additional setae in instar I; urogomphus distinctly shorter than LLAS in instar III, 1-segmented, with numerous additional setae in instar I, with secondary setae and subbasal suture present in instar II and III.

Instar I (Figs. 215I, J; 216I – L; 217I; 220C, F).
Head (Fig 220C). Head length = 1.90 mm; head width = 1.71 mm; head length: head width = 1.12; **head capsule** (Fig. 220C): rounded in outline with lateral margin slightly diverging anteriorly; cervical region well-delimited, temporal angle distinct; occipital suture present; anterior margin of frontoclypeus distinctly arcuate, with a lateral lobe on each side, with club-shaped clypeolabral setae; **antenna** uniramous, distinctly shorter than head length; A4 slightly longer than A3; **mandible:** inner margin smooth, neither toothed or serrated, with numerous short setae on apical half; **maxilla:** stipes broad, with inner margin not setose (except for short and sparse setae) and without hook-like structures basally; galea 1-segmented; MX3 subequal in length to MX2; **labium** with prementum subrectangular, anterior margin deeply emarginate; LB2 slightly longer than LB1.

Thorax. Legs (Figs. 215I, J; 216I – L), pro- and mesothoracic legs not pseudo-chelate; tarsal claws with basoventral spinulae present.

Abdomen (Figs. 217I; 220F) LLAS = 1.63 mm; urogomphus L = 1.31 mm; segment 7 fully sclerotized ventrally; segment 8 (Fig. 220F) with numerous additional setae, fairly elongate, subconical, with lateral margins straight to slightly concave, subparallel to slightly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon very short, subtriangular in outline with apex distinctly sinuate apically; urogomphus 1-segmented (Fig. 217I), without subbasal suture, about 0.80x LLAS, with numerous additional setae.

Instar II. Unknown.

Instar III. As for instar I except for the following characters:
Head. Head length = 3.00 – 3.30 mm; head width = 2.60 – 3.00 mm; head length: head width = 1.08 – 1.31; **antenna:** A4 slightly shorter than A3 ; **maxilla:** MX3 slightly shorter than MX2; **labium:** LB2 distinctly shorter than LB1.

Thorax. Legs with natatory setae located in a single row on posterodorsal margin of tarsi.

Abdomen. LLAS = 2.90–3.10 mm; urogomphus L = 1.80–2.20 mm; urogomphus about 0.60–0.80x LLAS, with a subbasal suture.

Comments. The inclusion of the genus *Neoscutopterus* within the tribe Colymbetini is supported by their larvae which resemble those of *Rhantus* and *Colymbetes* in most features including the presence of basoventral spinulae on the tarsal claws and the 1-segmented urogomphus with numerous secondary setae in instar II and III. Larvae of *Neoscutopterus* differ from those of *Rhantus* and *Colymbetes* by their larger size, the antenna distinctly shorter than head length, the deeply emarginate anterior margin of the prementum, the presence of only a few basoventral spinulae on tarsal claw, and the absence of natatory setae on femora and tibiae. Instar I of *Neoscutopterus* is unique among Nearctic Colymbetinae for the mandible and the urogomphi possess numerous additional setae (Alarie 1995*b*, 1998). Another striking feature of instar I is the presence of numerous additonal setae on abdomen segment 8. This feature is also occurs in *Matus* as well as in the Palearctic genus *Meladema* Laporte (Alarie 1995*b)*.

The larvae of both species are known (Hilsenhoff 1989; Nilsson and Hilsenhoff 1991) and Hilsenhoff (1993*b)* provides a key for the separation of instar 3 larvae..

Genus *Matus* Aubé

Figs. 214E, F, K, N, O, P, Q; 217J; 221; 235A

Diagnosis. Head capsule with occipital suture always present; antenna biramous; maxillary stipes narrow and elongate, without spine-like structures on inner margin; prementum with anterior margin emarginate; pro- and mesothoracic legs pseudo-chelate; tarsal claws with basoventral spinulae absent; legs with natatory setae present; abdomen segment 7 with ventral surface fully sclerotized in instar I; abdomen segment 8 with numerous additional setae in instar 1; urogomphus fairly short, distinctly shorter than LLAS in instar III, 1-segmented, with 8 primary setae in instar I, with secondary setae present and subbasal suture absent in instar II and III.

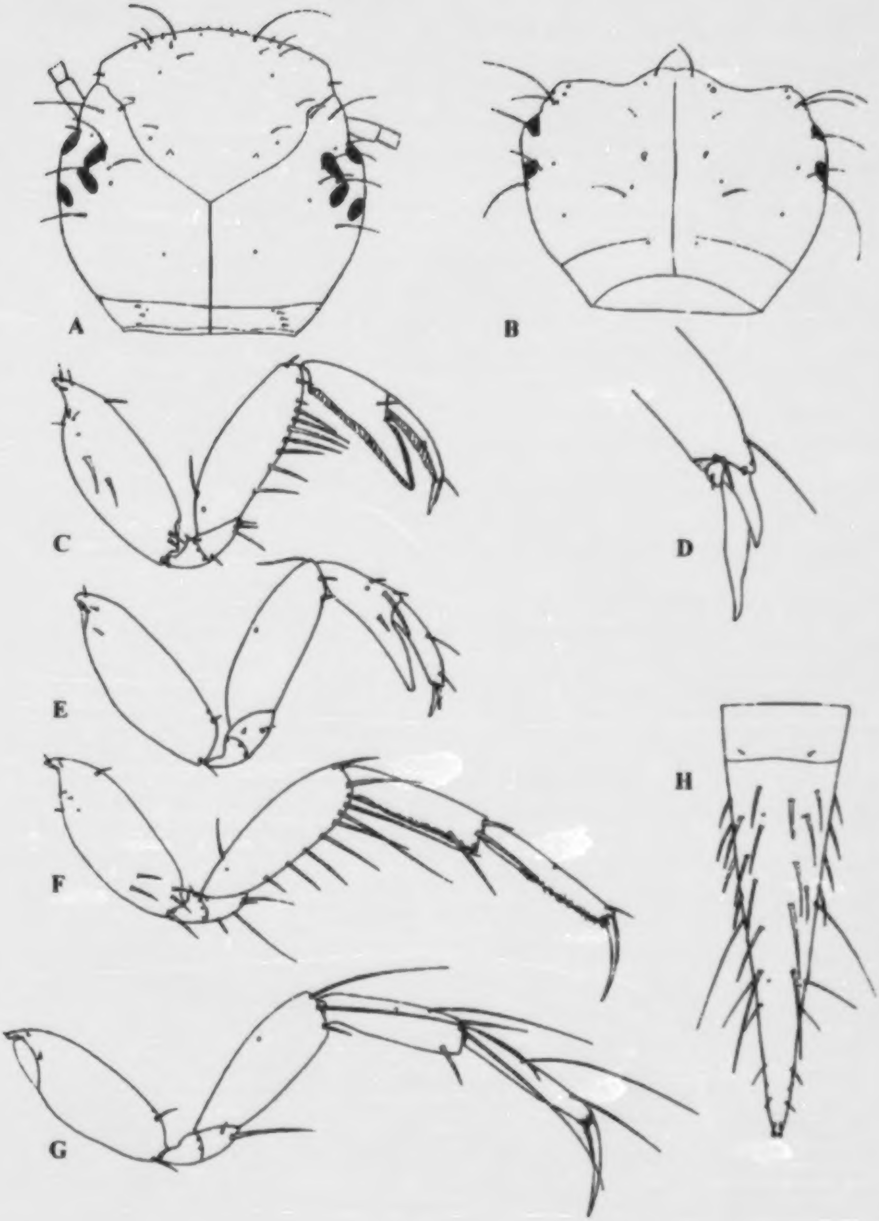

Fig. 221. Colymbetinae, *Matus bicarinatus*, instar I. A - head capsule dorsal. B - head capsule ventral. C – E - prothroracic leg, C - anterior, D - apex of protarsus, E - posterior. F – G - metathoracic leg, F - anterior, G - posterior. H - last abdominal segment, dorsal. Drawn to different scales.

Instar I (Figs. 214E, F, K, N, O, P, Q; 217J; 221).

Head (Figs. 214E, F, K, N, O, P, Q; 215A, B). Head length = 0.71 – 0.72 mm; head width = 0.75 – 0.78 mm; head length: head width = 0.91–0.96; **head capsule** (Fig. 221A, B): rounded in outline as long as broad; cervical region not delimited, temporal angles not marked (i.e., lateral margins not constricted posteriorly); occipital suture present; anterior margin of frontoclypeus slightly arcuate, without lateral lobe on each side, with short spine-like clypeolabral setae; **antenna** (Fig. 214E, F): biramous, distinctly shorter than head length; A4 distinctly shorter than A3; **mandible** (Fig. 214K): inner margin distinctly toothed, without setae; **maxilla** (Fig. 214P, Q): stipes narrow, inner margin not setose without hook-like structures basally; galea 2-segmented; MX3 distinctly longer than MX2; **labium** (Fig. 214N, O) with prementum subtrapezoidal, anterior margin sligthly concave; LB2 subequal to LB1 in length.

Thorax. Legs (Fig. 221C – G), pro- and mesothoracic legs pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen (Figs. 217J; 221H). LLAS = 1.17–1.24 mm; urogomphus L = 0.60–0.61 mm; segment 7 fully sclerotized ventrally; segment 8 (Fig. 221H) with numerous additional setae, distinctly conical, lateral margin straight, strongly and evenly converging from base to apex of siphon; siphon short, triangular in outline with apex rounded to acute; urogomphus 1-segmented (Fig. 217J), without subbasal suture, about 0.50x LLAS, with only primary setae; basal articulations of seta UR4 median in position, not contiguous to setae UR2 and UR3.

Instar II. As instar I except for the following characters:

Head. Head length = 0.99 mm; head width = 1.05 mm; head length: head width = 0.94; **head capsule:** occipital suture present; **antenna**: shorter than head length; **maxilla:** MX3 slightly longer than MX2; **labium:** LB2 shorter than LB1.

Thorax. Legs with natatory setae located in a single row on the posterodorsal margin of femora, tibiae, and tarsi.

Abdomen. LLAS = 1.60 mm; urogomphus L = 0.62 mm; urogomphus about 0.40x LLAS, with secondary setae present.

Instar III (Fig. 235A).

Head. Head length = 1.20 mm; head width = 1.40 mm; head length: head width = 0.86; **antenna:** distinctly shorter than head length; **maxilla**: MX3 subequal to slightly longer than MX2; **labium**: LB2 shorter than LB1.

Abdomen. LLAS = 2.00 mm; urogomphus L = 0.59 mm; urogomphus about 0.30x LLAS, with secondary setae.

Comments. Larvae of *Matus* are unique among the Dytiscidae in the pseudo-chelate form of the pro- and mesothoracic legs. Other characteristics that make them distinctive within the Colymbetinae are: the typical shape of the maxillary stipes, the joint-like aspect of the latero-apical sensorium on A3 (i.e., A3'), the short A4, the absence of lateral lobes on frontoclypeus and the very short urogomphus.

The mature larva of *M. ovatus* have been described (Wolfe and Roughley 1985). Alarie (1995*b*, 1998) provided a detailed chaetotaxic analysis of selected structures of instar I of *M. bicarinatus*. Hilsenhoff (1993*b)* provides a key for the separation of instar 3 larvae of the two Canadian species.

Tribe Coptotomini

Fig. 235B

Diagnosis. Medium to large size; frontoclypeus not developed into a frontal projection (nasale) but with a distinct anteromedian frontal horn, triangular in outline, with many clypeolabral setae in instar I; coronal suture elongate about 0.60 x head length; occipital suture absent in instar II and III; mandible channelled, not curved upward apically; maxillary galea present, 1-segmented, and finger-like; maxillary palpifer well-developed; antennomeres 2 and 3, and maxillary palpomere 3 not secondarily subdivided in instar III; tibia and tarsus lacking anteroventral natatory setae; abdomen segments 1 to 6 with a lateral tracheal gill on each side; abdomen segment 6 membranous ventrally; abdomen segment 7 lacking a lateral fringe of natatory setae; abdomen segment 8 with a lateral fringe of natatory setae in instar II and III; urogomphus 1-segmented, elongate, distinctly longer than LLAS, with numerous additional setae in instar I.

Genus *Coptotomus* Say

Fig. 235B

Instar I.

Head. Head length (including frontal horn) = 0.82 – 0.86 mm; head width = 0.53 – 0.56 mm; head length: head width = 1.50 – 1.60; **head capsule:** subtriangular to subtrapezoidal, with lateral margin straight, converging posteriorly, distinctly longer than broad; cervical region weakly delimited, temporal angle weakly marked (i.e., lateral margin slightly constricted posteriorly); occipital suture absent; epicranial suture well-developed, coronal suture about 0.60x as long as head length; frontoclypeus not developed anteriorly into a nasale, anterior margin of frontoclypeus convex, with a lateral lobe on each side, with two pronged extension anteromedially, each prong bearing clavate setae; egg-bursters present; occipital foramen deeply indented ventrally, straight dorsally; stemmata subequal in size; **antenna:** biramous, distinctly longer than head length; A1 to A3 not secondarily subdivided, A4 distinctly shorter than A3; **mandible:** channelled, broad, short, and sharply falcate, inner margin minutely toothed apically and with a tuft of small hairs medially; **maxilla:** cardo reduced, subrectangular; stipes fairly broad, inner margin with 3 hook-like structures basally lacking setae near galea; galea 1-segmented and finger-like; palpifer well-developed, similar to a palpomere; MX1 to MX3 not secondarily subdivided; MX3 subequal to longer than MX2; **labium:** prementum subrectangular, broader than long, with anterior margin straight; ligula absent; LB1 and LB2 not secondarily subdivided, LB2 shorter than LB1.

Thorax. Legs: without natatory setae; pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen. LLAS = 0.29–0.47 mm; urogomphus L = 1.53 mm; with a pair of tracheal gills extending laterally on segments 1 to 6, fully but lightly sclerotized dorsally, membranous ventrally, except segment 8 fully sclerotized; segments 7 and 8 lacking a fringe of natatory setae laterally; segment 8 short and slender, subtrapezoidal, lacking additional setae, lateral margins straight, subparallel; siphon very reduced; urogomphus 1-segmented, about 3.50–5.30x as long as LLAS, with numerous additional setae.

Instar II. As instar I except for the following characters:
Head. Head length = 1.44 – 1.51 mm; head width = 0.85 – 0.91 mm; head length: head width = 1.65 – 1.75; **head capsule:** more ovate in outline, with cervical region more marked; occipital suture absent; frontoclypeus with a medial prominent lobe margined with numerous clavate setae; egg bursters absent; parietals with numerous temporal spines; **maxilla:** MX3 subequal to MX2 in length; **labium:** LB2 shorter than LB1.

Thorax. Legs: with natatory setae located in a single row on the posterodorsal margin of femur, tibia and tarsus.

Abdomen. LLAS = 1.33 mm; urogomphus L = 2.03 mm; segment 7 weakly sclerotized ventrally; segment 8 with a row of short natatory setae laterally; urogomphus about 1.50x as long as LLAS, with numerous natatory setae laterally.

Instar III (Fig. 235B). As for instar II except for the following characters:
Head. Head length = 2.23 mm; head width =1.40 mm; head length: head width =1.60.

Thorax. Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 2.50 mm; urogomphus L = 2.73 mm; segments 1 to 7 each with a pair of spiracles on pleural region; urogomphus about 1.20x LLAS.

Comments. Larvae of the genus *Coptotomus* are unique among the Dytiscidae by possessing well extended tracheal gills on abdomen segments 1 to 6 as well as having a frontal horn emerging from anterior portion of the frontoclypeus. It is also noteworthy that *Coptotomus* is the single genus outside of the Dytiscinae possessing a lateral fringe of natatory setae on abdomen segment 8 (instar II and III).

In North America the larvae of *C. longulus* (as *C. interrogatus*) have been described (Wilson 1923; Barman 1972). Hilsenhoff (1993*b*), on examination of a long series of trap-collected larvae, was unable to find characters to distinguish between species.

SUBFAMILY DYTISCINAE

Figs. 222 – 224; 236B

Diagnosis. Large size; frontoclypeus not developed into a frontal projection (nasale), at most with a short trilobate process anteriorly, triangular in outline, with many clypeolabral setae in instar I; coronal suture elongate more than 0.40x head length; occipital suture absent or present; mandible channelled or not-channelled, not curved upward apically; maxillary galea present (1-segmented, spine-like or finger-like), or absent; maxillary palpifer reduced to well-developed; antennomeres 2 and 3, and maxillary palpomere 3 secondarily subdivided in instar III; tibia and tarsus with a single row of natatory setae on anteroventral margin; abdomen segments 1 to 6 lacking lateral tracheal gills; abdomen segment 6 membranous ventrally; abdomen segments 7 with a lateral fringe of natatory setae in instar II and III; abdomen segment 8 with a lateral fringe of natatory setae; siphon lacking lateral lobe and lanceolate setae; urogomphus 1-segmented, vestigial to short, at most subequal to LLAS in length, with primary or additional setae in instar I.

Instar I

Head. Head length = 1.05 – 4.00 mm; head width = 0.81 – 3.50 mm; head length: head width = 1.08 – 1.58; **head capsule:** variously shaped, subovate to subtriangular, or subtrapezoidal with lateral margin converging posteriorly; slightly to distinctly longer than broad; cervical region distinctly marked or not, temporal angle distinct or not (i.e. lateral margin constricted posteriorly or not); occipital suture present or absent; epicranial suture well-developed, coronal suture about 0.40–0.60x as long as head length; frontoclypeus with anterior margin variously shaped, smoothly convex to strongly arcuate or trilobate, with a lateral lobe on each side; anterior margin of frontoclypeus with variously shaped clypeolabral setae; egg-bursters present or absent; occipital foramen deeply indented ventrally, straigth or deeply indented dorsally; anterodorsal and posterodorsal stemmata larger or subequal in size to other four; **antenna:** uniramous or biramous, distinctly shorter to or longer than head length; A1 to A3 secondarily subdivided or not; A4 distinctly shorter than A3; **mandible:** channelled or not channelled, broad or narrow, sharply falcate, with inner margin toothed or not and,at least, with a tuft of short hairs medially; **maxilla:** cardo reduced, subtriangular; stipes broad or narrow and elongate, barely to densely and minutely setose along inner margin, and with a row of long middorsal spine-like setae present or absent; galea present or absent, where present 1-segmented, short, spine-like or finger-like; palpifer reduced to well-developed; MX1 to MX3 secondarily subdivided or not; MX3 subequal to or longer than MX2; **labium:** prementum variously shaped, usually broader than long, with anterior margin either convex, bisinuate, V-shaped, or bilobate; ligula present or absent, where present either unifid and not sinuate apically, or bifid and at least slightly sinuate apically, ligula glabrous or with more or less elongate spine-like setae; LB1 and LB2 secondarily subdivided or not, LB2 longer to or shorter than LB1.

Thorax. Legs, natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur and tiba; natatory setae present or absent on posterodorsal margin of tarsus; pro- and mesothoracic legs not pseudo-chelate; tarsal claw lacking basoventral spinulae.

Abdomen. LLAS = 1.20–6.00; urogomphus L (excluding *Cybister*) = 0.55–3.00 mm; lacking lateral tracheal gills, segments 1 to 6 fully sclerotized or mostly membranous dorsally, fully membranous ventrally; segment 7 sclerotized dorsally, membranous ventrally; segment 8 more or less elongate, fully sclerotized, subcylindrical to subconical, with a fringe of natatory setae on lateral margin; siphon short, abruptly truncate apically; urogomphus 1-segmented, about 0.40–1.00x as long as LLAS (except in *Cybister* where it is vestigial), lacking a subbasal suture, with additional natatory setae present or not; if natatory setae absent, basal articulations of primary setae UR2, UR3 and, sometimes, UR4 close together proximally but not contiguous.

Instar II. As instar I except for the following characters:

Head. Head length = 1.40 – 6.00 mm; head width = 1.25 – 5.50 mm; head length: head width = 0.80 – 1.45; **head capsule:** cervical region distinctly marked; occipital suture present; egg-bursters absent; parietals with temporal spines present or absent.

Thorax. Legs: natatory setae present or absent on dorsal margin of coxa and ventral margin of trochanter; on tarsus, natatory setae present in a single row either on posterodorsal margin or both on posterodorsal and anteroventral margins.

Abdomen. LLAS =1.60–8.00 mm; urogomphus L (excluding *Cybister*) = 0.70–5.50 mm; segment 7 fully sclerotized or not, with a fringe of natatory setae laterally or absent; urogomphus about 0.30–0.80x as long as LLAS, with natatory setae present or absent, where present natatory setae located both on outer and inner margins.

Instar III. As for instar II except for the following characters:
Head. Head length = 2.40 – 9.00 mm; head width = 1.57 – 8.50 mm; head length: head width = 0.80 – 1.62. **Thorax.** Mesothorax with a pair of spiracles on pleural region.

Abdomen. LLAS = 1.80–10.00 mm; urogomphus L (excluding *Cybister*) = 0.80–4.50 mm; segments 1 to 7 each with a pair of spiracles on pleural region; urogomphus about 0.30–0.80x LLAS.

Comments. Larvae of Dytiscinae are the only known Dytiscidae possessing a fringe of natatory setae on the anteroventral margin of the femur and tibia. Also, Dytiscinae are distinctive by the presence of a lateral fringe of natatory setae on abdomen segments 7 (from instar II) and 8 (from instar I), as well the secondary annulation of antennomeres 2 and 3 and maxillary palpomere 3 in instar III.

Key to genera of Dytiscinae of North America

Key to Instar I

1. Anterior margin of frontoclypeus trilobate (Fig. 223B); egg-bursters absent; maxillary galea absent (Fig. 223C); antennomeres 1 to 3 (Fig. 223B), maxillary palpomeres 2 and 3, and labial paplpomeres 1 and 2 secondarily subdivided (Fig. 223C); abdomen segments 1 to 6 mainly membranous dorsally (Fig. 223A); urogomphus vestigial(Fig. 223A) . . . . *Cybister* Curtis, p. 925

1'. Anterior margin of frontoclypeus smoothly convex to strongly arcuate (Figs 222A; 224); maxillary galea present (Fig. 224D); antennomeres, maxillary and labial palpomeres not secondarily subdivided (Fig. 224C, D); abdomen segments 1 to 6 fully sclerotized dorsally; urogomphus well-developed (Fig. 224A) 2

2(1). Occipital foramen deeply indented dorsally (Fig. 222A, E); antero- and posterodorsal stemmata larger than the other four (Fig. 222B); galea spine-like (Fig. 222H); maxillary stipes broad with a dorsal row of spine-like setae (Fig. 222H); ligula present (222C, F); anterior margin of frontoclypeus smoothly convex 3

2'. Occipital foramen at most slightly indented dorsally; stemmata subequal in size; galea finger-like (Fig. 224D; maxillary stipes narrow, lacking a dorsal row of spine-like setae (Fig. 224D); ligula absent (Fig. 224C); anterior margin of frontoclypeus strongly arcuate 5

3(2). Ligula unifid, not sinuate apically . . . . *Graphoderus* Dejean, p. 920

3'. Ligula bifid, at least slightly sinuate apically (Fig. 224C, F) 4

4(3). Ligula deeply sinuate apically, with short spine-like setae (Fig. 222C) .... *Acilius* Leach, p. 918

4'. Ligula shortly sinuate apically, with elongate spine-like setae (Fig. 222F) .... *Thermonectus* Dejean, p. 922

5(2). Antenna biramous; anterior margin of prementum bilobate or trilobate; urogomphus with primary setae only; smaller species, head length 2.00 mm or less .... *Hydaticus* Leach, p. 923

5'. Antenna uniramous; anterior margin of prementum V-shaped (Fig. 224C); urogomphus with a row of natatory setae on outer margin (Fig. 224F); larger species, head length greater than 2.00 mm .... *Dytisicus* Linnaeus, p. 927

Key to Instar II and III

1. Anterior margin of frontoclypeus trilobate (Fig. 223B); maxillary galea absent (Fig. 223C); abdomen segments 1 to 6 mainly membranous dorsally (Fig. 223A); urogomphus vestigial (Fig. 223A); temporal spines absent; abdomen segment 7 not sclerotized ventrally ....*Cybister* Curtis, p. 925

1'. Anterior margin of frontoclypeus smoothly convex to strongly arcuate (Fig. 222A, E, G); maxillary galea present (Fig. 222H; 224J); abdomen segments 1 to 6 fully sclerotized dorsally; urogomphus well-developed (Figs. 222D; 224G); temporal spines present or absent; abdomen segment 7 sclerotized ventrally 2

2(1). Occipital foramen deeply indented dorsally (Fig. 222A, E); antero- and posterodorsal stemmata larger than the other four (Fig. 222B); galea spine-like (Fig. 222H); maxillary stipes broad with a dorsal row of spine-like setae (Fig. 222H); ligula present (Fig. 222F, H) .... 3 [Larvae of *Eretes* Laporte have a short ligula with four apical spines which distinguishes them from larvae of the Thermonectini (specimens not examined, fromWhite and Brigham 1996)]

2'. Occipital foramen at most slightly indented dorsally; stemmata subequal in size; galea finger-like (Fig. 224J); maxillary stipes narrow, lacking a dorsal row of spine-like setae (Fig. 224J); ligula absent (Fig. 224I) 5

3(2). Ligula unifid, not sinuate apically .... *Graphoderus* Dejean, p.. 920

3'. Ligula bifid. at least slightly sinuate apically (Fig. 222C, F) 4

4(3). Ligula deeply sinuate apically, with short spine-like setae (Fig. 222C) ....*Acilius* Leach, p. 918

4'. Ligula shortly sinuate apically, with elongate spine-like setae (Fig. 222F) .... *Thermonectus* Dejean, p. 922

5(2). Antenna biramous; anterior margin of prementum bilobate; urogomphus with primary setae only; temporal spines present; antennomere 1, maxillary palpomere 1, and labial palpomeres 1 and 2 not secondarily subdivided; tarsus lacking an anteroventral row of natatory setae . . . . *Hydaticus* Leach, p. 923

5'. Antenna uniramous (Fig. 224H); anterior margin of prementum V-shaped (Fig. 224I); urogomphus with natatory setae both on outer and inner margins (Fig. 224G); temporal spines absent; antennomere 1 (Fig. 224H), maxillary palpomere 1 (Fig. 224J) and labial palpomeres 1 and 2 (Fig. 224I) secondarily subdivided; tarsus with an anteroventral row of natatory setae (Fig. 224K) . . . . *Dytisicus* Linnaeus, p. 927

Genus *Acilius* Leach

Figs. 222A – C

Diagnosis. Anterior margin of frontoclypeus smoothly convex; egg-burters present in instar I; occipital foramen deeply indented dorsally; antero- and posterodorsal stemmata larger than the other four; temporal spines present in instar II and III; mandible channelled; antenna uniramous; antennomere 1 not secondarily subdivided; maxillary galea spine-like; maxillary stipes broad and with a dorsal row of spine-like setae; maxillary palpomere 2 not secondarily subdivided; anterior margin of prementum convex, with a deeply sinuate bifid ligula bearing short spine-like setae; labial palpomeres 1 and 2 not secondarily subdivided; tarsus with an anteroventral row of natatory setae in instar II and III; abdomen segments 1 to 6 fully sclerotized dorsally; abdomen segment 7 lacking a lateral row of natatory setae in instar I and sclerotized ventrally in instar II and III; urogomphus well-developed, with primary setae only; primary seta UR4 inserted proximally to setae UR2 and UR3.

Instar I.

Head. Head length = 1.11 – 1.60 mm; head width = 0.81 – 1.05 mm; head length: head width = 1.24 – 1.39; **head capsule:** subtriangular, with lateral margin converging posteriorly; distinctly longer than broad; cervical region marked or not, temporal angle distinct or not (i.e., lateral margin constricted posteriorly or not); occipital suture present or absent; coronal suture about 0.40x as long as head length; frontoclypeus with anterior margin smoothly convex; anterior margin of frontoclypeus with numerous bluntly pointed clypeolabral setae; egg-bursters present; occipital foramen deeply indented both ventrally and dorsally (Fig. 222B); anterodorsal and posterodorsal stemmata larger than the other four; **antenna:** uniramous, distinctly shorter than head length; antennomeres not secondarily subdivided; **mandible:** broad and sharply falcate, channelled, inner margin smooth or minutely toothed, with a tuft of hairs basally; **maxilla:** stipes fairly broad and elongate, densely and minutely setose along inner margin, and with a row of long spine-like setae middorsally; galea 1-segmented, spine-like; palpifer reduced; maxillary papomeres not secondarily subdivided; MX3 distinctly longer than MX2; **labium:** prementum subtrapezoidal, about as long as broad, with anterior margin convex; ligula bifid, deeply sinuate and with short spines apically; labial palpomeres not secondarily subdivided; LB2 , subequal to or slightly shorter than LB1.

Thorax. Legs: natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur and tibia.

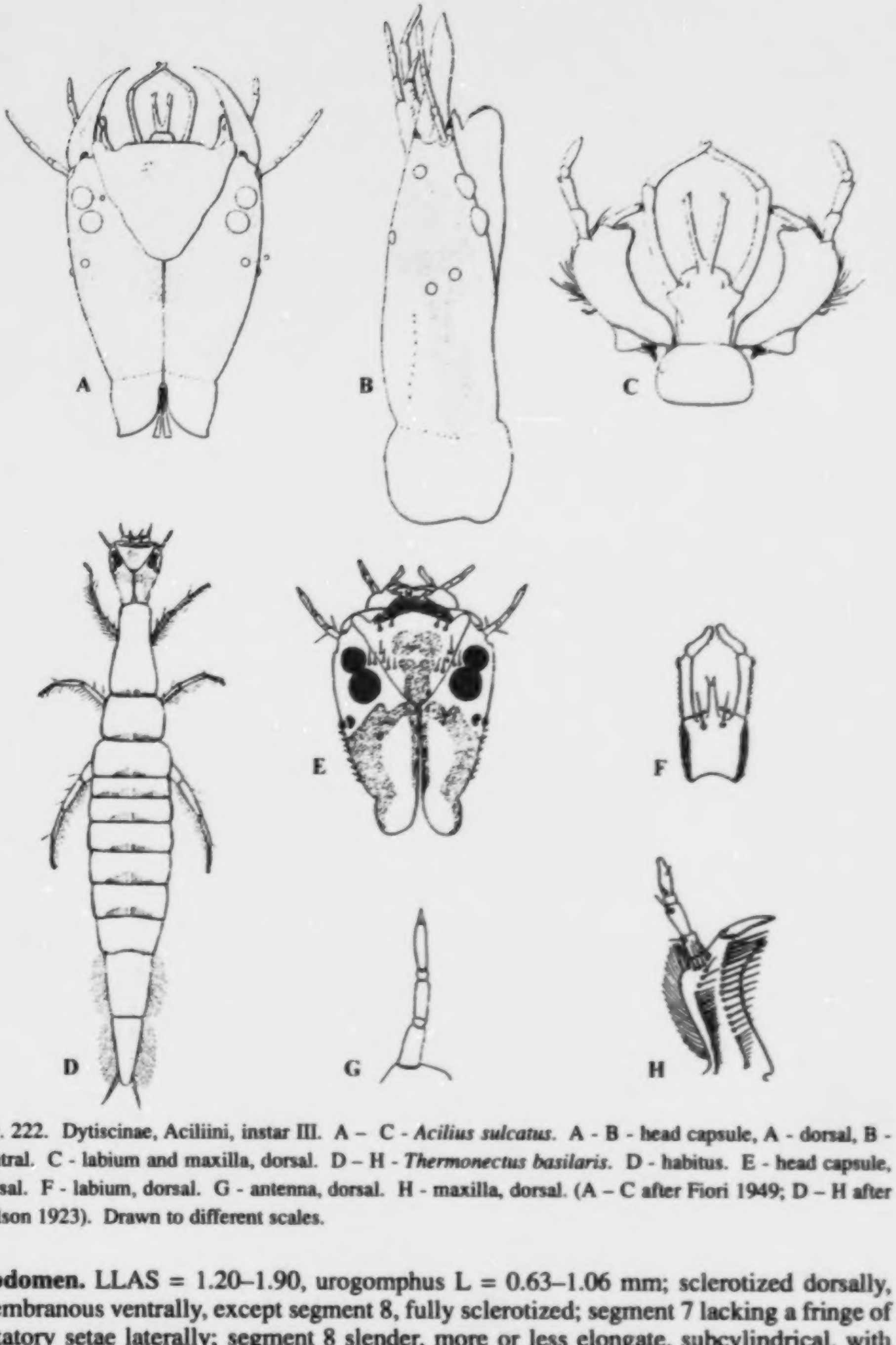

Fig. 222. Dytiscinae, Aciliini, instar III. A – C - *Acilius sulcatus*. A - B - head capsule, A - dorsal, B - ventral. C - labium and maxilla, dorsal. D – H - *Thermonectus basilaris*. D - habitus. E - head capsule, dorsal. F - labium, dorsal. G - antenna, dorsal. H - maxilla, dorsal. (A – C after Fiori 1949; D – H after Wilson 1923). Drawn to different scales.

Abdomen. LLAS = 1.20–1.90, urogomphus L = 0.63–1.06 mm; sclerotized dorsally, membranous ventrally, except segment 8, fully sclerotized; segment 7 lacking a fringe of natatory setae laterally; segment 8 slender, more or less elongate, subcylindrical, with lateral margins straight, smoothly converging from base to point of insertion of urogomphi, more abruptly converging thereafter; siphon short, abruptly truncate apically; urogomphus 1-segmented, about 0.50–0.60x as long as LLAS, with only primary setae; seta UR4 inserted close to setae UR2 and UR3.

Instar II. As instar I except for the following characters:
Head. Head length = 1.57 – 2.50 mm; head width = 1.28 – 1.67 mm; head length: head width = 1.25 – 1.36; **head capsule:** occipital suture present; parietals with numerous temporal spines; egg- bursters absent; rudimentary visual organ absent; **mandible:** inner margin with a tuft of short hairs basally and apically; **labium:** LB2 shorter than LB1.

Thorax. Legs: natatory setae located in a single row both on the posterodorsal and the anteroventral margins of femur, tibia and tarsus.

Abdomen. LLAS =1.78–3.15 mm; urogomphus L =1.06–1.75 mm; segment 7 fully sclerotized, with a fringe of natatory setae laterally; urogomphus about 0.50 to 0.60x as long as LLAS.

Instar III (Fig. 222A – C). As for instar II except for the following characters:
Head (Fig. 222A – C). Head length = 2.50 – 3.45 mm; head width = 1.90 – 2.29 mm; head length: head width = 1.30 – 1.50; **antenna** (Fig. 222A: A2 and A3 secondarily subdivided basally; **maxilla** (Fig. 222C): MX3 secondarily subdivided basally, subequal in length to MX2.

Abdomen. LLAS = 3.00–3.60 mm; urogomphus L = 0.80–1.92 mm; urogomphus about 0.30–0.60x LLAS.

Comments. Members of the tribe Aciliini are distinctive among the subfamily Dytiscinae. The larvae have a characteristic plump, arched body, a small and narrow head distinctly sinuate along the dorsal margin of the occipital foramen, two dorsal stemmata much larger than the remaining four, a broad maxillary stipes provided with numerous spine-like setae and a characteristic spine-shaped galea. Even though very characteristic, the presence of a ligula should not be viewed as exclusive to members of the tribe Aciliini since a similar elongate process is known to occur in *Cybister*. However, larvae of *Cybister* differ from those of Aciliini in several distinctive features (see under *Cybister)*. Larvae of Aciliini are also distinctive within the Dytiscinae for antennomeres 2 and 3, and maxillary palpomeres 2 and 3 are not secondarily subdivided in instar II.

Larvae of *Acilius* ressemble to those of the related genera *Graphoderus* and *Thermonectus*. These three genera may be distinguished by the typical shape of ligula. Larvae of *Acilius* and *Thermonectus* have a typical bifid ligula instead of unifid in *Graphoderus*. Although very shortly sinuate apically, the ligula of members of *Thermonectus* should be considered also as bifid. Larvae of *Acilius* may be distinguished from those of *Thermonectus* by a ligula deeply sinuate apically and armed with short spine-like setae. In *Thermonectus*, the ligula has two very elongate spine-like setae.

In North America the larvae of *A. semisulcatus* and *A. fraternus* has been described (James 1969; Watts 1970; Barman 1972; Wolfe 1980). Hilsenhoff (1993*a)* gives a key to separate the larvae of the four species that occur in Wisconsin.

Genus *Graphoderus* Dejean

Diagnosis. Anterior margin of frontoclypeus smoothly convex; egg-burters present in instar I; occipital foramen deeply indented dorsally; antero- and posterodorsal stemmata larger than the other four; temporal spines present in instar II and III; mandible channelled; antenna uniramous; antennomere 1 not secondarily subdivided; maxillary galea spine-like; maxillary stipes broad and with a dorsal row of spine-like setae; maxillary palpomere 2 not secondarily subdivided; anterior margin of prementum convex, with a unifid ligula armed with short spine-like setae; labial palpomeres 1 and 2 not secondarily subdivided; tarsus with an anteroventral row of natatory setae in instar II and III; abdomen segments 1 to 6 fully sclerotized dorsally; abdomen segment 7 lacking a lateral row of natatory setae in instar I and sclerotized ventrally in instar II and III; urogomphus well-developed, with primary setae only; primary seta UR4 inserted proximally to setae UR2 and UR3.

Instar I.
Head. Head length = 1.05 – 1.75 mm; head width = 0.95 mm; head length: head width = 1.25 – 1.58; **head capsule:** subtriangular, with lateral margin converging posteriorly; distinctly longer than broad; cervical region marked or not, temporal angle distinct or not (i.e. lateral margin constricted posteriorly or not); occipital suture present or absent; coronal suture about 0.40x as long as head length; frontoclypeus with anterior margin smoothly convex; anterior margin of frontoclypeus with numerous bluntly pointed clypeolabral setae; egg-bursters present; occipital foramen deeply indented both ventrally and dorsally; anterodorsal and posterodorsal stemmata larger than the other four; **antenna:** uniramous, distinctly shorter than head length; antennomeres not secondarily subdivided; **mandible:** broad and sharply falcate; channelled; inner margin minutely toothed, with a tuft of hairs basally; **maxilla:** stipes fairly broad and elongate, densely and minutely setose along inner margin, and with a row of long spine-like setae middorsally; galea 1-segmented, spine-like; palpifer reduced; maxillary palpomeres not secondarily subdivided, MX3 longer than MX2; **labium:** prementum subtrapezoidal, slightly longer than broad, with anterior margin convex; ligula unifid, not sinuate apically and with several short spines; labial palpomeres not secondarily subdivided, LB2 subequal to or slightly shorter than LB1.

Thorax. Legs: natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur and tibia.

Abdomen. LLAS = 1.50–2.30, urogomphus L = 0.55–0.85 mm; sclerotized dorsally, membranous ventrally, except segment 8, fully sclerotized; segment 7 lacking a fringe of natatory setae laterally; segment 8 slender, more or less elongate, subcylindrical, with lateral margin straight, smoothly converging from base to point of insertion of urogomphi, more abruptly converging thereafter, with a fringe of natatory setae; siphon short, abruptly truncate apically; urogomphus 1-segmented, about 0.40x as long as LLAS, with only primary setae; seta UR4 inserted close to setae UR2 and UR3.

Instar II. As instar I except for the following characters:
Head. Head length = 1.75 – 2.20 mm; head width = 1.25 – 1.67 mm; head length: head width = 1.25 – 1.36; **head capsule:** cervical region distinctly marked; occipital suture present; parietals with numerous temporal spines; egg-bursters absent; rudimentary visual organ absent; **mandible:** inner margin with a tuft of hairs basally and apically; **labium:** LB2 shorter than LB1.

Thorax. Legs: natatory setae located in a single row both on the posterodorsal and the anteroventral margins of femur, tibia and tarsus.

Abdomen. LLAS =2.00-3.00 mm; urogomphus L = 0.70–0.90 mm; segment 7 fully sclerotized, with a fringe of natatory setae laterally; urogomphus about 0.30x as long as LLAS.

Instar III. As for instar II except for the following characters:
Head. Head length = 2.46 – 3.60 mm; head width = 1.57 – 2.40 mm; head length: head width = 1.37 – 1.62; **antenna:** A2 and A3 secondarily subdivided basally; **maxilla:** MX3 secondarily subdivided basally, subequal to MX2 in length.

Abdomen. LLAS = 3.30–3.90 mm; urogomphus L = 1.00–1.25 mm; urogomphus about 0.30x LLAS.
Comments. In North America the larvae of *G. perplexus* (Watts 1970, as *G. zonatus* (Hoppe)) and *G. liberus* (Barman 1972) have been described. Hilsenhoff (1993*a*) provides a key to the larvae of the North American species except characters separating *G. fascicollis* and *G. occidentalis* were not found. It is noteworthy that the larvae of *G. liberus* are as distinctive from other species of the genus as are the adults, supporting the rather isolated position of the species.

See under *Acilius*.

Genus *Thermonectus* Dejean

Figs. 222D – H

Diagnosis. Anterior margin of frontoclypeus smoothly convex; egg-burters present in instar I (assumed on presence in other member of the tribe Aciliini); occipital foramen deeply indented dorsally; antero- and posterodorsal stemmata larger than the other four; temporal spines present in instar II and III; mandible channelled; antenna uniramous; antennomere 1 not secondarily subdivided; maxillary galea spine-like; maxillary stipes broad and with a dorsal row of spine-like setae; maxillary palpomere 2 not secondarily subdivided; anterior margin of prementum convex, with a shortly sinuate bifid ligula bearing elongate spine-like setae; labial palpomeres 1 and 2 not secondarily subdivided; tarsus with an anteroventral row of natatory setae in instar II and III; abdomen segments 1 to 6 fully sclerotized dorsally; abdomen segment 7 lacking a lateral row of natatory setae in instar I and sclerotized ventrally in instar II and III; urogomphus well-developed, with primary setae only; primary seta UR4 inserted proximally to setae UR2 and UR3.

Instars I and II. Unknown.

Instar III (Fig. 222D – H).
Head (Fig. 222D – H). Head length = 2.45 – 2.53 mm; head width = 1.95 – 2.03mm; head length: head width =1.25–1.39; **head capsule** (Fig. 222E): obovate to subtriangular, with lateral margins converging posteriorly; distinctly longer than broad; cervical region well-delimited, temporal angle distinct (i.e., lateral margin distinctly constricted posteriorly); coronal suture about 0.40x as long as head length; frontoclypeus with anterior margin smoothly convex, with numerous bluntly pointed or subclavate clypeolabral setae; parietals with numerous temporal spines; egg-bursters absent; occipital foramen deeply indented both ventrally and dorsally; anterodorsal and posterodorsal stemmata larger than the remaining four; **antenna** (Fig. 222G): uniramous, distinctly shorter than head length; A2 and A3 secondarily subdivided basally; **mandible:** broad and sharply falcate, inner margin minutely toothed, with a tuft of hairs basally and apically; **maxilla** (Fig. 222H): stipes fairly broad and elongate, densely and minutely setose along inner margin, with a longitudinal row of spine-like setae middorsally; galea 1-segmented, spine-like; palpifer reduced; MX3 secondarily subdivided basally, and subequal to MX2 in length; **labium** (Fig. 222F): prementum subtrapezoidal, longer than broad, with anterior margin convex; ligula bifid, shortly

sinuate apically, and with two elongate spine-like setae; labial palpomeres not secondarily subdivided, LB2 shorter than LB1.

Thorax: natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur, tibia and tarsus.

Abdomen. LLAS = 2.78 mm; urogomphus L = 1.20 mm; sclerotized dorsally, membranous ventrally except segments 7 and 8 fully sclerotized; segments 7 and 8 with a fringe of natatory setae laterally; segment 8 slender, more or less elongate, subcylindrical, with lateral margins straight, smoothly converging from base to point of insertion of urogomphi, abruptly converging thereafter; siphon, abruptly truncate apically; urogomphus 1-segmented, about 0.30–0.50x as long as LLAS, with only primary setae; seta UR4 inserted close to setae UR2 and UR3.

Comments. In North America the larvae of *T. basillaris* and *T. ornaticollis* have been described (Wilson 1923) and Hilsenhoff (1993*a)* gives a key for their separation. See under *Acilius*.

Genus *Hydaticus* Leach
Fig. 236B

Diagnosis. Anterior margin of frontoclypeus strongly arcuate; egg-burters present in instar I; occipital foramen almost straight dorsally; stemmata subequal in size; temporal spines present in instar II and III; mandible channelled; antenna biramous; antennomere 1 not secondarily subdivided; maxillary galea finger-like; maxillary stipes narow, lacking a dorsal row of spine-like setae; maxillary palpomere 2 scondarily subdivided in instar II and III; anterior margin of prementum bilobed, lacking a ligula; labial palpomeres 1 and 2 not secondarily subdivided; tarsus without an anteroventral row of natatory setae in instar II and III; abdomen segments 1 to 6 fully sclerotized dorsally; abdomen segment 7 with a lateral row of natatory setae in instar I and sclerotized ventrally in instar II and III; urogomphus well-developed, with primary setae only; primary seta UR4 inserted more distally than setae UR2 and UR3.

Instar I.
Head. Head length = 1.10 – 1.75 mm; head width = 1.00 – 1.43 mm; head length: head width = 1.08 – 1.09; **head capsule:** subtriangular, with lateral margin arcuate, strongly converging posteriorly, slightly longer than broad; cervical region weakly delimited, temporal angle more or less distinct (i.e., lateral margin not distinctly constricted posteriorly); occipital suture present; coronal suture about 0.50x as long as head length; frontoclypeus with anterior margin strongly arcuate, with numerous clavate clypeolabral setae; egg-bursters present; occipital foramen deeply indented ventrally, almost straight dorsally; stemmata subequal in size; **antenna:** biramous, slightly shorter than head length; antennomeres not secondarily subdivided; **mandible:** sharply falcate, inner margin not toothed, with a tuft of small hairs midapically; **maxilla:** stipes fairly narrow and elongate, inner margin barely setose with 2 to 3 small spines, lacking a row of middorsal spine-like setae; galea 1-segmented, finger-like; palpifer short, similar to a palpomere; maxillary palpomeres not secondarily subdivided; MX3 subequal to MX2 in length; **labium:** prementum subglobular to subrectangular, broader than long, with anterior margin bilobate; ligula absent; labial palpomeres not secondarily subdivided; LB2 subequal to LB1 in length.

Thorax. Legs: natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur and tibia.

Abdomen. LLAS = 1.10–1.80; urogomphus L = 0.70–1.15 mm; abdomen segments sclerotized dorsally, membranous ventrally except segment 8 fully sclerotized; segments 7 and 8 with a fringe of natatory setae laterally; segment 8 slender, more or less elongate, subcylindrical, lateral margins straight, subparallel to point of insertion of urogomphi, slightly converging thereafter; siphon short, abruptly truncate apically; urogomphus 1-segmented, about 0.50–0.70x LLAS, with only primary setae; seta UR4 inserted more distally than setae UR2 and UR3.

Instar II. As instar I except for the following characters:
Head. Head length = 1.40 – 2.23 mm; head width = 1.30 – 2.10 mm; head length: head width = 1.09 – 1.21; **head capsule:** egg bursters absent; parietals with numerous temporal spines; rudimentary visual organ absent; **antenna:** shorter than head length; A2 and A3 secondarily subdivided basally; **maxilla:** MX2 and MX3 secondarily subdivided basally; MX3 shorter than MX2; **labium:** anterior margin of prementum bilobate or trilobate; LB2 slightly shorter than LB1.

Thorax. Legs: natatory setae located in a single row on dorsal margin of coxa, on ventral margin of trochanter, both on the posterodorsal and anteroventral margins of femur and tibia, and on the posterodorsal margin of tarsus.

Abdomen. LLAS =1.60–2.65 mm; urogomphus L =1.00-1.48 mm; segment 7 fully sclerotized; urogomphus about 0.40–0.80x LLAS.

Instar III (Fig. 236B). As for instar II except for the following characters:
Head. Head length = 2.40 – 3.50 mm; head width = 2.00 – 3.00 mm; head length: head width = 1.16 – 1.17; **labium:** LB2 distinctly shorter than LB1.

Abdomen. LLAS = 1.80–2.85 mm; urogomphus L = 1.00–2.10 mm; urogomphus about 0.50–0.90x as long as LLAS.

Comments. Morphologically, larvae of *Hydaticus* show some similarities both with Aciliini and Dytisicini. Like Aciliini, larvae of *Hydaticus* have antennomere 1, maxillary palpomere 1, and labial palpomeres 1 and 2 not secondarily subdivided, as well as possessing temporal spines in instar II and III. On the other hand, larvae of *Hydaticus* resemble those of *Dytiscini* by the shape of the anterior margin of the frontoclypeus, the maxillary galea and the maxillary stipes, and by the absence of a ligula.

Larvae of *Hydaticus* differ from those of other Dytiscinae by the typical bilobate shape of the anterior margin of the prementum. Instar II and III of the subgenus *Guignotites* differ from other *Hydaticus* by presence of a trilobate prementum. Whilst no representatives of *Guignotites* are known to occur in Canada and Alaska, two species, *H. bimarginatus* (Say) and *H. rimosus* Aubé are found in the United States (Roughley and Pengelly 1981).

In North America, the mature larva of *H. aruspex* was described by Watts (1970) (as *H. stagnalis* (Fab.). Hilsenhoff (1993*a)* provides a key for the separation of the larvae of *H. aruspex* and *H. piceus*.

Genus *Cybister* Curtis
Fig. 223

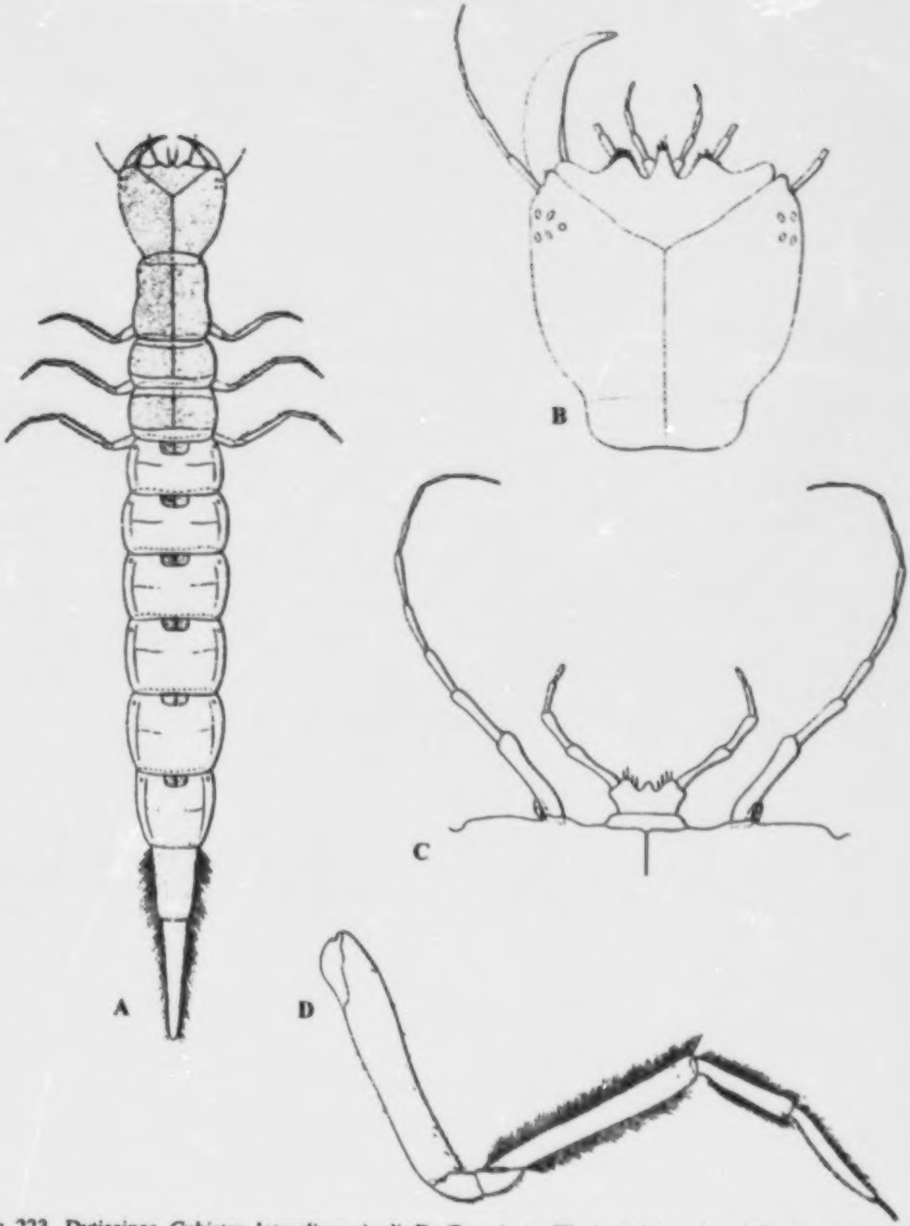

Fig. 223. Dytiscinae, *Cybister lateralimarginalis* De Geer, instar III. A - habitus, dorsal. B - head capsule, dorsal. C - maxilla and labium, dorsal. D - prothoracic leg. (after Fiori 1949). Drawn to different scales.

Diagnosis. Anterior margin of frontoclypeus trilobate; egg-burters absent in instar I; occipital foramen straight dorsally; stemmata subequal in size; temporal spines absent in instar II and III; mandible not-channelled; antenna biramous; antennomere 1 secondarily subdivided from instar I; maxillary galea absent; maxillary stipes narow, lacking a dorsal row of spine-like setae; maxillary palpomere 2 scondarily subdivided from instar I; anterior margin of prementum bisinuate, with a non-sinuate unifid ligula larking spine-like setae; labial palpomeres 1 and 2 secondarily subdivided from instar I; tarsus without an anteroventral row of natatory setae in instar II and III; abdomen segments 1 to 6 mostly membranous dorsally; abdomen segment 7 with a lateral row of natatory setae in instar I and not sclerotized ventrally in instar II and III; urogomphus vestigial.

Instar I.
Head. Head length = 4.00 mm; head width = 3.00 mm; head length: head width = 1.33; **head capsule:** subtrapezoidal, with lateral margin converging posteriorly; longer than broad; cervical region weakly marked, temporal angle more or less distinct (i.e. lateral margin weakly constricted posteriorly); occipital suture present; coronal suture about 0.60x as long as head length; frontoclypeus with a trilobate process antero-medially, each lobe of process margined with numerous hair-like setae; egg-bursters absent; occipital foramen distinctly indented ventrally, straight dorsally; stemmata subequal in size; **antenna** (Fig. 223B): biramous, longer than head length; A1 to A3 secondarily subdivided, A1 into two segments, A2 and A3 into three segments; **mandible:** narrow and sharply falcate, covered with long hairs dorso-apically; inner margin not toothed, with a fringe of short, stiff, and blunt spines along its center; **maxilla** (Fig. 223C): stipes fairly narrow and elongate, inner margin lacking hook-like structures, with 3 spine-like setae, lacking a middorsal row of spine-like setae; galea absent; palpifer elongate, similar to a palpomere; maxillary palpomeres secondarily subdivided, MX1 and MX3 into 3 segments, MX2 into 2 segments; MX3 longer than MX2; labium (Fig. 223C): prementum subtrapezoidal, broader than long, anterior margin bisinuate and projecting a little unifid ligula lacking spine-like setae; labial palpomeres secondarily subdivided into 2 segments medially; LB2 subequal to or shorter than LB1.

Thorax: natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur and tibia, and on posterodorsal margin of tarsus.

Abdomen. LLAS = 6.00 mm; urogomphus L = vestigial; segments 1 to 6 mostly membranous except for a little dorsoproximal sclerite; segment 7 wholly sclerotized dorsally and laterally, membranous ventrally; segment 8 fully sclerotized; segments 7 and 8 with a fringe of natatory setae laterally; segment 8 slender, very elongate, subconical, with lateral margins straight, gradually converging from base to apex of siphon; siphon short, abruptly truncate apically; urogomphus vestigial, reduced to a small ventral lobe, with only 4 primary setae and apparently lacking a subbasal suture.

Instar II. As instar I except for the following characters:
Head. Head length = 4.55 – 5.00 mm; head width = 3.13 – 4.00 mm; head length: head width = 1.25 – 1.45; **antenna:** shorter than head length; **labium:** LB2 distinctly shorter than LB1.

Thorax. Legs: natatory setae located in a single row on dorsal margin of coxa, on ventral margin of trochanter, both on posterodorsal and anteroventral margins of femur and tibia, and on posterodorsal margin of tarsus (Fig. 223D).

Abdomen. LLAS = 6.40–8.00 mm; urogomphus L = vestigial.

Instar III (Fig. 223). As for instar II except for the following characters:

Head (Fig. 223A – C). Head length = 5.80 – 7.00 mm; head width = 5.10 – 6.00 mm; head length: head width = 1.13 – 1.17.

Abdomen. LLAS = 8.70–10.00 mm; urogomphus L = vestigial.

Comments. The larvae of *Cybister* are very distinctive within the Dytiscinae with several unique morphological features, namely a nonchannelled mandible, a trilobate process on anterior margin of frontoclypeus, absence of a ligula, secondary annulation of antennomeres 1 to 3, maxillary paplpomeres 1 to 3, and labial palpomeres 1 and 2 from instar I larva, abdomen segments 1 to 6 mainly membranous dorsally, and the very reduced size of urogomphus. Instar I differs from other dytiscid larvae in lacking egg-bursters on frontoclypeus.

In North America, the mature larva of *C. fimbriolatus* was described by Wilson (1923).

Genus *Dytiscus* Linnaeus
Fig. 224

Diagnosis. Anterior margin of frontoclypeus strongly arcuate; egg-burters present in instar I; occipital foramen straight dorsally; stemmata subequal in size; temporal spines absent in instar II and III; mandible channelled; antenna uniramous; antennomere 1 secondarily subdivided in instar II and III; maxillary galea finger-like; maxillary stipes narow, lacking a dorsal row of spine-like setae; maxillary palpomere 2 secondarily subdivided in instar II and III; anterior margin of prementum V-shaped, lacking a ligula; labial palpomeres 1 and 2 secondarily subdivided in instar II and III; tarsus with an anteroventral row of natatory setae in instar II and III; abdomen segments 1 to 6 fully sclerotized dorsally; abdomen segment 7 with a lateral row of natatory setae in instar I and sclerotized ventrally in instar II and III; urogomphus well-developed, with numerous natatory setae.

Instar I (Fig. 224A – F).
Head (Fig. 224A – D). Head length = 0.98 – 4.00 mm; head width = 1.33 – 3.50 mm; head length: head width = 1.09 – 1.36; **head capsule** (Fig. 224A): subtriangular with lateral margin strongly diverging anteriorly; longer than broad; cervical region weakly delimited, temporal angle more or less distinct (i.e. lateral margin weakly constricted posteriorly); occipital suture present; coronal suture about 0.50–0.60x as long as head length; frontoclypeus with anterior margin strongly arcuate, with numerous bluntly pointed clypeolabral setae; egg-bursters present; occipital foramen deeply indented ventrally, straight dorsally; stemmata subequal in size; **antenna** (Fig. 224B): uniramous, subequal to head length in length; antennomeres not secondarily subdivided; **mandible:** sharply falcate, inner margin not toothed, with a tuft of small hairs medially and apically; **maxilla** (Fig. 224D): stipes fairly narrow and elongate with inner margin barely setose and lacking spine-like setae middorsally; galea 1-segmented, short and finger-like; palpifer well-developed, similar to a palpomere; maxillary palpomeres not secondarily subdivided, MX3 subequal to MX2 in length; **labium** (Fig. 224C): prementum subrectangular, broader than long, with anterior margin deeply emarginate; ligula absent; labial palpomeres not secondarily subdivided, LB2 shorter or longer than LB1.

Thorax. Legs (Fig. 224E): natatory setae located in a single row both on the posterodorsal and anteroventral margins of femur and tibia.

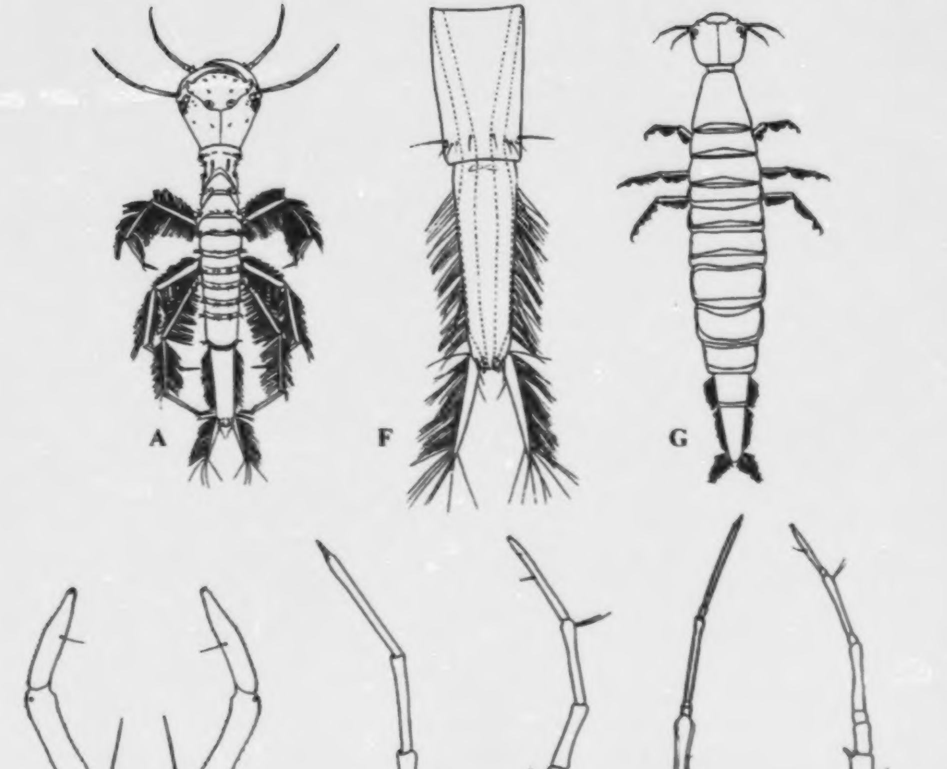

Fig. 224. Dytiscinae, *Dytiscus fasciventris*. A – F - instar I. G - K - instar III. A - habitus. B - antenna. C - labium. D - maxilla. E - prothoracic leg. F - abdominal segments VII and VIII with urogomphi dorsal. G - habitus. H - antenna. I - labium. J - maxilla. K - prothoracic leg. (after James 1969). Drawn to different scales.

Abdomen (Fig. 224F). LLAS = 2.25–4.50, urogomphus L = 1.30–3.00 mm; abdomen segments sclerotized dorsally, membranous ventrally except segment 8 fully sclerotized; segments 7 and 8 with a fringe of natatory setae laterally; segment 8 slender, more or less elongate, subcylindrical, with lateral margins straight to slightly concave, subparallel from base to point of insertion of urogomphi, abruptly converging thereafter; siphon short, abruptly truncate apically; urogomphus 1-segmented, about 0.50–1.00x as long as LLAS, with numerous natatory setae on outer margin; primary setae UR2, UR3, and UR4 not distinct from natatory setae.

Instar II. As instar I except for the following characters:

Head. Head length = 2.22 – 6.00 mm; head width = 3.40 – 5.50 mm; head length: head width = 0.80 – 1.19; **head capsule:** egg bursters absent; parietals lacking temporal spines; rudimentary visual organ situated behind the postero-dorsal stemma; **antenna:** shorter than head length; A1 to A3 secondarily subdivided basally (Fig. 224H); **maxilla:** MX1 to MX3 secondarily subdivided basally (Fig. 224J); MX3 shorter than MX2 ; **labium:** LB1 and LB2 secondarily subdivided basally (Fig. 224I); LB2 shorter than LB1.

Thorax: natatory setae located in a single row on dorsal margin of coxa, on ventral margin of trochanter, both on posterodorsal and anteroventral margins of femur, tibia and tarsus (Fig. 224K).

Abdomen. LLAS =4.00–7.00 mm; urogomphus L = 2.60–5.50 mm; segment 7 ventrally completely sclerotized,with a fringe of natatory setae laterally; urogomphus about 0.40–0.80x LLAS, with a fringe of natatory setae both on outer and inner margins.

Instar III (Fig. 224G – K). As for instar II except for the following characters:

Head (Fig. 224G – J). Head length = 3.26 – 9.00 mm; head width = 4.50 – 8.50 mm; head length: head width = 0.80 – 1.26; **maxilla** (Fig. 224J): MX3 slightly shorter than MX2; **labium** (Fig. 224I): LB2 shorter than than LB1.

Abdomen. LLAS = 4.90–8.50 mm; urogomphus L = 3.48–4.50 mm; urogomphus about 0.40 – 0.80x LLAS.

Comments: By their larger size, larvae of some species of *Dytiscus* may be confounded with those of *Cybister*. However, they may be separated on the basis of the many diagnostic features mentioned above under *Cybister*. Members of the genus *Dytiscus* differ from all other Dytiscinae by presence of natatory setae on urogomphus as well as by the V-shaped aspect of the anterior margin of the prementum (see also under *Hydaticus*).

In North America, the larvae of *D. cordieri*, *D. dauricus*, *D. fasciventris*, *D. hybridus*, and *D. verticalis* (Wilson 1923; James 1969; Watts 1970; Barman 1972) have been described.

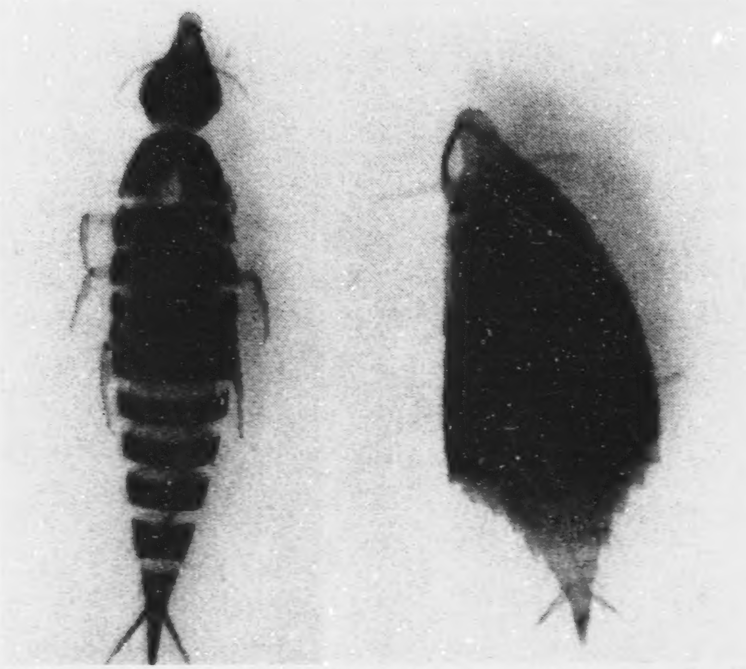

Fig. 225 (220). Hydroporinae, habitus of instar III, dorsal. A - *Desmopachria convexa*. B - *Hydrovatus pustulatus*.

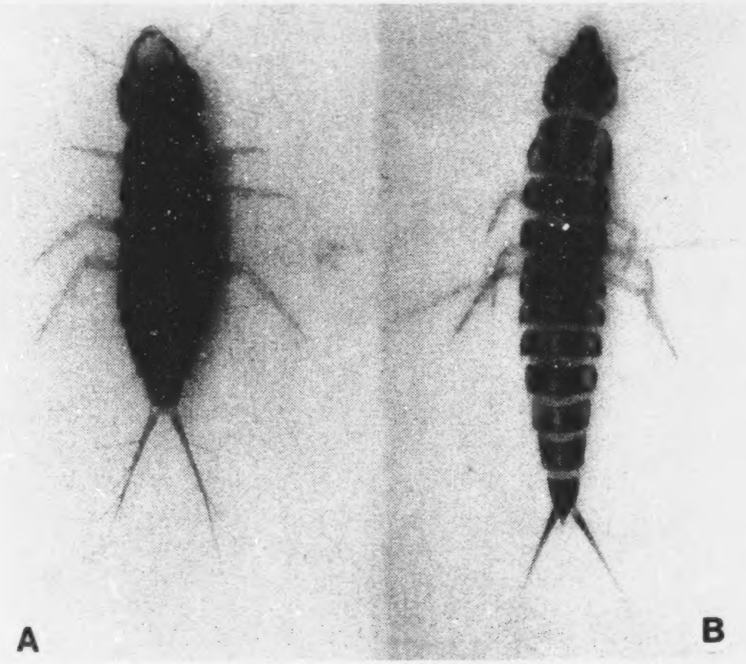

Fig. 226 (221). Hydroporinae, habitus of instar III, dorsal. A - *Heterosternuta wickhami*. B - *Neoporus undulatus*.

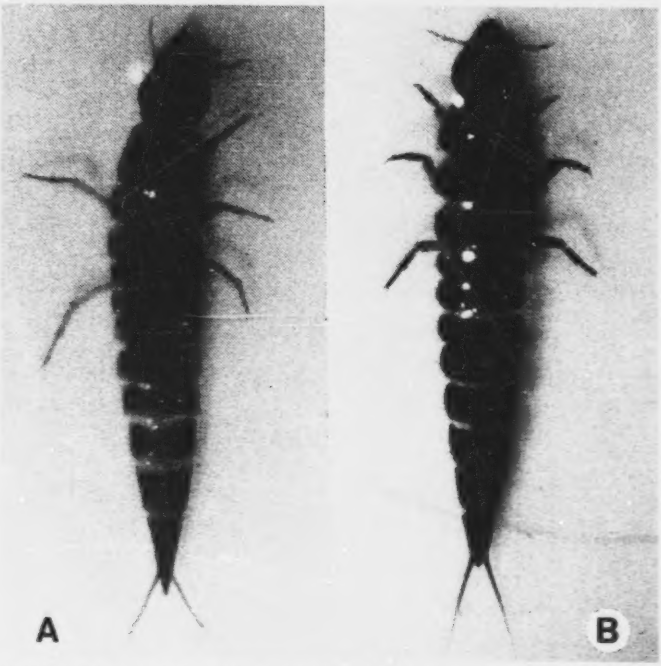

Fig. 227 (222). Hydroporinae, habitus of instar III, dorsal. A - *Hygrotus picatus*. B - *Hydroporus lapponum*.

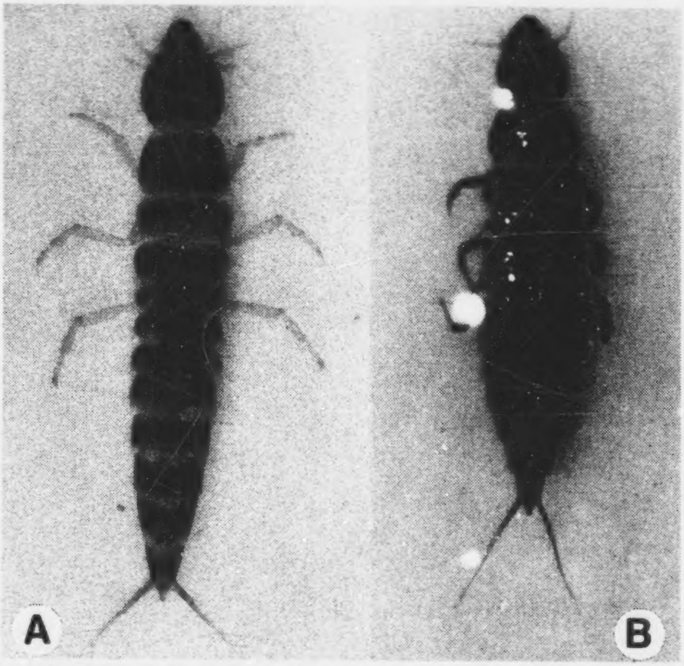

Fig. 228 (223). Hydroporinae, habitus of instar III, dorsal. A - *Sanfilippodytes compertus*. B - *Liodessus affinis*.

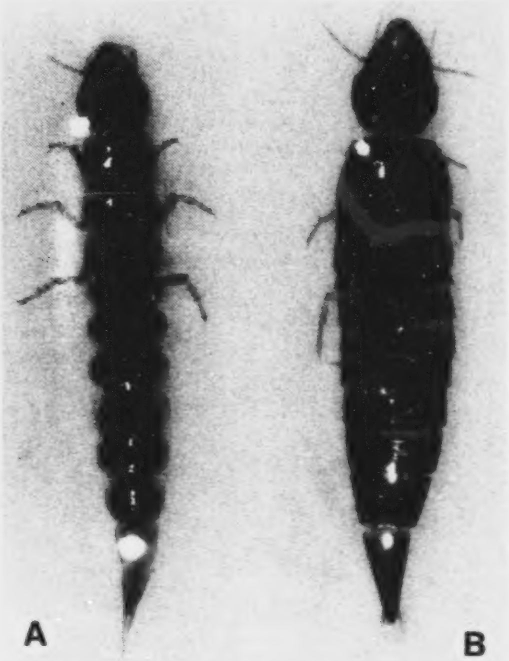

Fig. 229 (224). Hydroporinae, habitus of instar III, dorsal. A - *Hydrocolus paugus*. B - *Laccornis latens*.

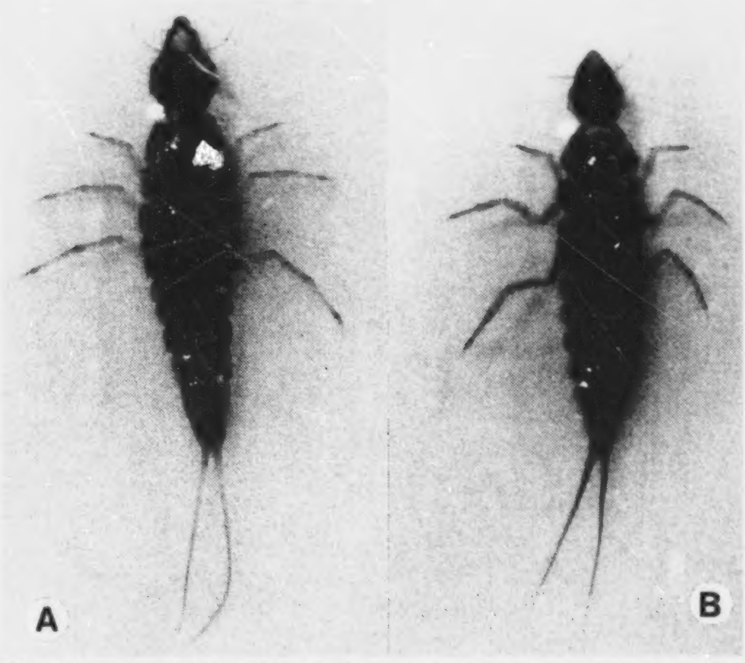

Fig. 230 (225). Hydroporinae, habitus of instar III, dorsal. A - *Stictotarsus griseostriatus*. B - *Nebrioporus rotundatus*.

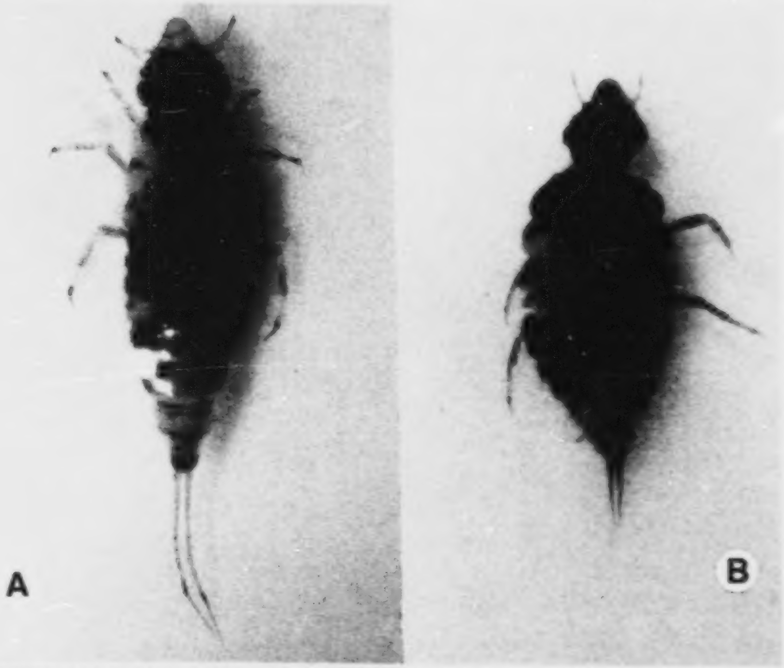

Fig. 231 (226). Hydroporinae, habitus of instar III, dorsal. A - *Oreodytes alaskanus*. B - *Oreodytes sierrae*.

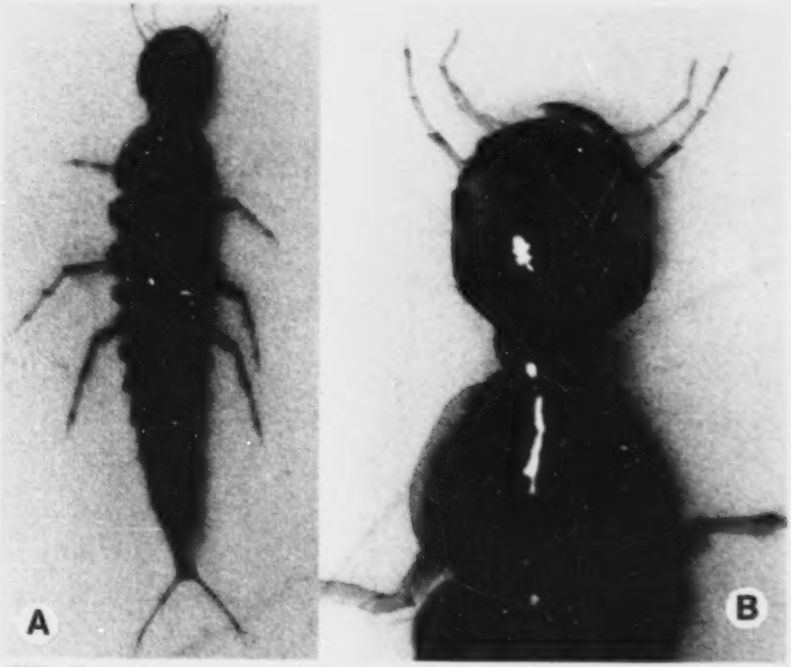

Fig. 232 (227). Colymbetinae, habitus of instar III, dorsal. A - *Agabus seriatus*. B - *Agabus bjorkmanae*.

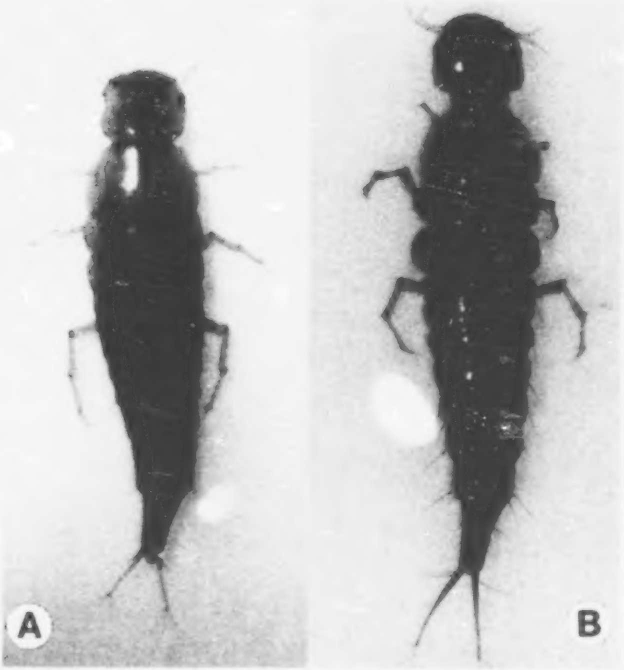

Fig. 233 (228). Colymbetinae, habitus of instar III, dorsal. A - *Ilybius angustior*. B - *Agabinus glabrellus*.

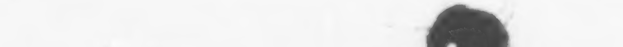

Fig. 234 (229). Colymbetinae, habitus of instar III, dorsal. A - *Rhantus binotatus*. B - *Colymbetes sculptilis*.

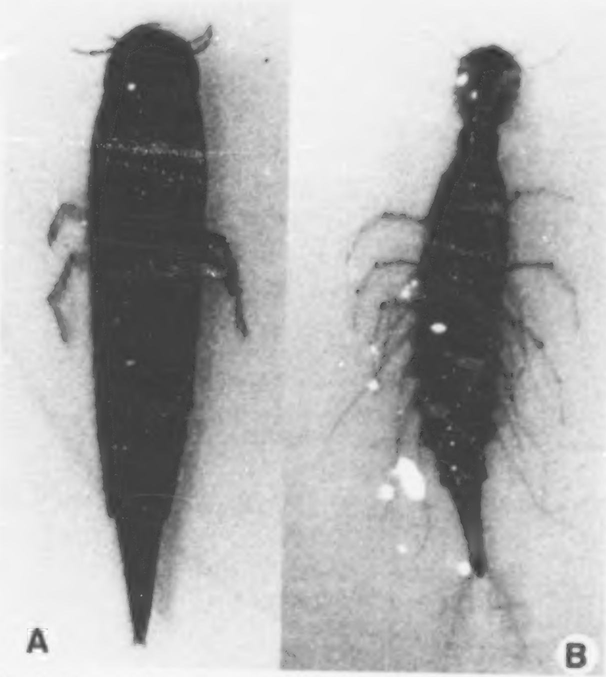

Fig. 235 (230). Colymbetinae and Coptotominae, habitus of instar III, dorsal. A - *Matus bicarinatus*. B - *Coptotomus longulus*.

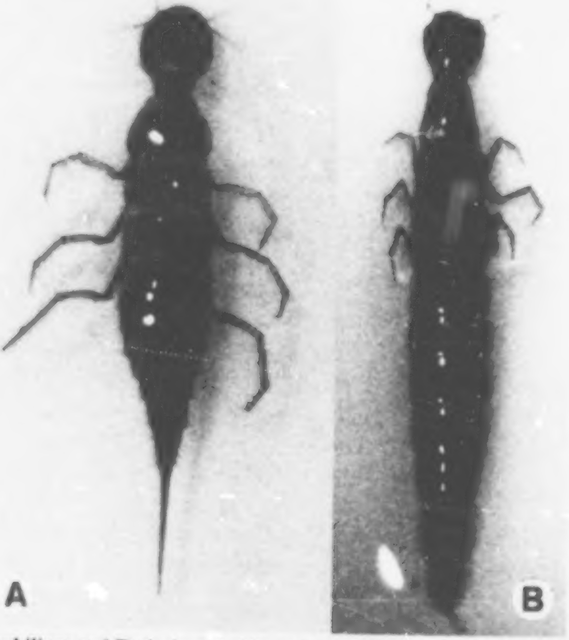

Fig. 236 (231). Laccophilinae and Dytiscinae, habitus of instar III, dorsal. A - *Laccophilus biguttatus*. B - *Hydaticus piceus*.

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